PB82-910206

U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESEARCH AND TECHNOLOGY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 15, NUMBER 6
JUNE 1, 1982

W82-02601 -- W82-03000
CODEN: SWRABW

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A monthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

RECONNAISSANCE OF THE HOT SPRINGS MOUNTAINS AND ADJACENT AREAS, CHURCHILL COUNTY, NEVADA,
Geological Survey, Menlo Park, CA. Water Resources Div.
N. E. Voegtly.
Available from OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 81-134, 1981. 10 p, 1 Plate, 13 Ref.

Descriptors: Structural geology, *Geologic fractures, Rocks, Mountains, *Stratigraphy, *Geohydrology, Test wells, *Geothermal studies, *Nevada, *Churchill County, Hot Springs Mountains, Thermal water, Geologic mapping.

A geologic reconnaissance of the Hot Springs Mountains and adjacent areas, which include parts of the Brady-Hazen and the Stillwater-Soda Lake Known Geothermal Resource Areas, during June-December 1975, resulted in a reinterpretation of the nature and location of some Basin and Range faults. In addition, the late Cenozoic stratigraphy has been modified, chiefly on the basis of radiometric dates of volcanic rocks by U.S. Geological Survey personnel and others. The Hot Springs Mountains are in the western part of the Basin and Range province, which is characterized by east-west crustal extension and associated normal faulting. In the surrounding Trinity, West Humboldt, Stillwater, and Desert Mountains, Cenozoic rocks overlie 'basement' rocks of the Paleozoic and Mesozoic age. A similar relation is inferred in the Hot Springs Mountains. Folding and faulting have taken place from the late Tertiary to the present. (USGS)
W82-02830

1B. Aqueous Solutions and Suspensions

TRANSFER OF VOLATILE SUBSTANCES FROM WATER TO THE ATMOSPHERE,
Eidgenoessesche Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
C. Matter-Muller, W. Gujer, and W. Giger.
Water Research, Vol 15, No 11, p 1271-1279, November, 1981. 5 Fig, 4 Tab, 19 Ref.

Descriptors: *Aeration, *Mass transfer, *Organic compounds, Surfactants, Diffusion coefficient, Trickling filters, Air stripping, Wastewater treatment, Activated sludge process, Bubbles, Volatile compounds, Air-water interfaces, Air pollution.

Surface aeration systems and trickling filters can efficiently strip volatile compounds during wastewater treatment. Bubble aeration systems are less efficient, and pure oxygen activated sludge plants are inefficient. Theory and experimental data on aerator systems in batch and continuous flow reactors are analyzed. Equations are given for three ranges of the degree of saturation of the exit gas (far from saturated, partially saturated with the volatile compound, and in equilibrium with the liquid). The ratios of the molecular diffusion coefficient of a compound and oxygen in the water were as follows: oxygen, 1.00; 1,1-dichloroethylene, 0.62; tetrachloroethylene, 0.55; benzene, 0.53; toluene, 0.53; 1,2,4-trimethylbenzene, 0.39; and 1,4-dichlorobenzene, 0.39. The surface active agents tested (Marlon A, bactopeptone, and palmitic acid) had variable effects on the mass transfer coefficients of tetrachloroethylene. (Cassar-FRC)
W82-02902

WATER-PHOSPHORIC ACID MEDIA: ELECTROCHEMICAL PROPERTIES,
Nancy-1 Univ. (France). Lab. de Chimie et 'Electrochimie Analytique.
C. Louis, and J. Bessiere.
Analytical Letters, Vol 13, No A 11, p 937-946, 1980. 1 Fig, 8 Ref.

Descriptors: *Electrochemistry, *Phosphoric acid, Chemical reactions, Electrolysis, Solutes, Acidity, Chemical properties.

Electroactivity ranges of water-phosphoric acid media were determined at various electrodes. The behavior of the ferricinium/ferrocene comparison system was studied. Electrodes used included polished platinum, various carbon, and mercury. The aqueous saturated calomel electrode was used as a reference system. The oxidizing properties of water-phosphoric acid media increased with increasing phosphoric acid concentration. Reducing properties in water-phosphoric acid mixtures depend on the acidity level and water activity. In the different mixtures used the thermodynamic range extended over 1.23 V. The electrochemical properties of the 5.5 M and 11.5 M phosphoric acid industrial mixtures could be compared. (Baker-FRC)
W82-02943

SETTLING VELOCITY OF SPHERICAL PARTICLES IN CALM WATER,
Ecole Polytechnique Federale de Lausanne (Switzerland).
J. L. Boillat, and W. H. Graf.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY 10, p 1123-1131, October, 1981. 6 Fig, 1 Tab, 10 Ref.

Descriptors: *Settling velocity, *Sediments, *Drag, Particulate matter, Physical properties, Water properties, *Particle size, Calm water.

The settling velocity of spherical particles 0.200 to 1.905 cm in diameter and 1.018 to 2.700 g per cu cm in density in calm water were measured by video techniques at a precision of 1/40 sec. The results were about 20% higher than the standard CTS=f(R) curve, which was developed from fixed spheres tested in wind tunnels. This preliminary data is not sufficient to propose a new drag coefficient for freely falling spheres. Further research is suggested, perhaps concerning the effects of the Strouhal number on the drag of freely falling spheres. (Cassar-FRC)
W82-02958

2. WATER CYCLE

2A. General

LAND SURFACE AND LAKE STORAGE DURING SNOWMELT RUNOFF IN A SUBARCTIC DRAINAGE SYSTEM,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
For primary bibliographic entry see Field 2C.
W82-02624

APPROXIMATE ERROR BOUNDS FOR SIMULATED HYDROGRAPHS,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. C. Garen, and S. J. Burges.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1519-1534, 1981. 2 Fig, 6 Tab, 25 Ref.

Descriptors: *Hydrographs, *Error analysis, Simulation, Errors, *Rainfall-runoff relationships, Rainfall, Storms, Rain, Model studies, Monte Carlo method, Mathematical studies, *Watersheds.

The applicability of first-order uncertainty analysis to a complex watershed model to quantify parameter error propagation and to gain an appreciation of the approximate magnitudes of model output uncertainty caused by different levels of parameter uncertainty was investigated. The study focuses on the estimation of error bounds for simulated hydrographs, assuming the model to be perfect and accounting only for output uncertainty caused by uncertainty in parameter values. First-order uncertainty analysis is applid to the Stanford Watershed Model to calculate the effects of parameter uncertainty as it propagates through the model. The first order approximations to the mean and standard deviation of model output are compared to estimates of the same quantities, using Monte Carlo analysis. This was done to identify the degree of parameter error for which the first order approximations are valid. First order analysis was found to give good approximations if the coefficients of variation on sensitive parameters were less than about 0.25. First order analysis allows a large reduction in computation over Monte Carlo methods for estimating error bounds on simulated hydrographs. Based upon storm types and initial moisture contents examined here it is clear that different streamflow uncertainty levels can be expected at different times of the year in any catchment. While the findings given here were developed for the particular watershed model, the method should be applicable to all complex moisture accounting rainfall-runoff models. (Baker-FRC)
W82-02678

ANALYSIS OF FLOOD HYDROGRAPHS FROM WETLAND AREAS,
G. L. Fagan, Jr.
PhD Dissertation, June, 1981. 301 p, 25 Fig, 28 Tab, 119 Ref, 4 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-18869.

Descriptors: *Hydrograph analysis, *Flood hydrographs, *Wetlands, *Unit hydrographs, Flood discharge, Precipitation, Runoff, Great Swamp, Passaic River basin, *New Jersey.

Many natural wetlands and water courses serve the valuable function of reducing flood peaks and lessening high flood stages. Such effects may be substantially altered or eliminated by man's activities. This research presents the results of a project to predict flood discharges from wetland areas. Hydrographs from several non-winter flood events resulting solely from precipitation, in the Great Swamp in the Passaic River Basin in New Jersey, were studied in an attempt to explain the runoff regimen that exists. Examination of the hydrographs showed that for a given precipitation volume, the volume of surface runoff during the flood event decreased with increasingly wetter antecedent precipitation conditions. This finding is contrary to what would generally be expected for a non-wetland area. In addition, a statistical analysis determined that the loss, which is the difference between the total precipitation volume and the runoff volume, was significantly correlated with the total precipitation volume and antecedent precipitation conditions. Unit hydrographs developed from flood hydrographs were studied and found to be inadequate as a means of predicting peak discharges for specified precipitation patterns. However it was found that the unit hydrograph peak generally decreased with increasing volume of precipitation excess and the duration of this excess. The analyses provided the basis of a statistical approach for predicting flood discharges with limited precipitation and flow data. The results of the research should be of significance in the planning and design of flood control works, the conservation and development of wetland areas, and the evaluation of flood risks for areas downstream of wetland areas. (Sinha-OEIS)
W82-02733

STUDIES OF BIOLOGICAL NITROGEN CYCLE PROCESSES IN THE UPPER WATERS OF THE OCEAN, WITH SPECIAL REFERENCE TO THE PRIMARY NITRITE MAXIMUM,
Scripps Institution of Oceanography, La Jolla, CA.
R. J. Olson.
PhD Dissertation, 1980. 264 p, 53 Fig, 15 Tab, Numerous Ref. University Microfilms International, Ann Arbor, MI; Order No GAX81-00032.

Descriptors: *Nitrogen cycle, *Marine biology, *Metabolism, Nitrates, Nitrites, Photosynthesis, Phytoplankton, Bacteria, Bioindicators, Biological properties, North Pacific Ocean.

An investigation of components of the marine nitrogen cycle in oxygenated waters was undertaken. Experiments with pure cultures of phytoplankton and natural populations of phytoplankton and bacteria were used to relate metabolic activities to observed distributions of nitrogenous nutrients. Two studies of the central North Pacific Gyre were done to determine the depth profiles of biologically important parameters in upper and deep waters. On the basis of observed nitrate and nitrite distributions, a simple box model was constructed which showed that the amount of nitrate entering the euphotic zone via mixing was sufficient to account for the appearance of nitrite in the primary nitrite maximum. Laboratory culture experiments with a marine diatom gave results consistent with the proposed nitrite loss during nitrate assimilation by phytoplankton. (Sinha-OEIS)
W82-02742

OUTFLOW OF VOLCANIC ROCK AND GAS DURING OPENING OF THE ARPA-SEVAN TUNNEL,
V. I. Nikolin, E. S. Matlak, A. V. Sarkisyan, and M. G. Bikineev.
Hydrotechnical Construction, No 6, p 581-586, June, 1980. 2 Fig, 2 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 6, p 24-27, June, 1980.

Descriptors: *Tunnel construction, *Geologic formations, Drilling, Volcanoes, Carbon dioxide, Water, Rocks, Rapid excavation, *Diversion structures, Arpa River, Sevan Lake, *Russia.

A 48.3 kilometer tunnel is being built to divert a portion of the Arpa River into Lake Sevan. The region through which the tunnel will pass is listed as seismically dangerous due to the tectonic processes which continue there even though volcanic activity in this region terminated in the Quaternary period. Rocks are basically magmatic varieties. The tunnel is being opened by the drill-and-blast method. During the opening of the tunnel, an influx of hot gasified water and long- and short-term active blower gas liberations occurred in significant amounts in virtually all tunnel cuts. The first such gas-dynamic phenomenon occurred on March 13, 1977, and was determined to belong to a class of porphyrite and carbon dioxide ejections. Overflows of mineral groundwater were found, saturated with carbon dioxide, associated with the large tectonic cracks and crushing zones. After the first heavy liberation of gas and water, outflows of carbon dioxide and water occurred at other stations. As a result of the gas-dynamic phenomena, rock debris was strewn over a distance of up to 150 meters from the cut, severely impairing the safety of the workers and leading to increased costs and construction time. The situation was investigated through the drilling of several boreholes. The following conclusions were drawn. All outflows occurred in porphyrites which were classed as water- and gas-water-bearing rocks at a depth of over 600 meters. Basic signs of porphyrite proneness to outflow include reduced strength and the extent to which the porphyrites are disturbed, increased venting of gas from blast holes during drilling, presence of circular macrocracks in cores, and separation of the core into thin disks or disintegration to a state of sand. (Baker-FRC)
W82-02772

MATHEMATICAL MODELS OF WATER YIELD WITH PARTICULAR REFERENCE TO MISSISSIPPI WATERSHEDS: INTERIM REPORT NO. 1, A STUDY OF SOME EMPIRICAL METHODS OF DETERMINING THE UNIT HYDROGRAPH,
Mississippi State Univ., Mississippi State.
V. P. Singh, and A. Baniukiewicz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168485, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, September, 1980. 198 p, 121 Fig, 22 Tab, 13 Ref. OWRT-A-129-MISS(1), 14-34-0001-0126.

Descriptors: Unit hydrographs, Matrix methods, Transform methods, Time series methods, Linear programming, Error analysis, Sensitivity analysis, Reproduction, Regeneration, *Prediction, *Statistical measures, *Ranking, *Small watersheds, Agricultural watersheds, *Mississippi, *Water yield, *Model studies, Linear theory, Statistical methods.

An attempt was made to evaluate, compare and rank nine different methods of deriving the unit hydrograph (UH) on a small agricultural watershed, which included (1) matrix methods, (2) transform methods, (3) time series methods, and (4) linear programming methods. Although the matrix methods, except for the least squares method, yield exact solution for the UH, these methods are not suitable for deriving the representative UH for a given watershed. However, transform, time series and linear programming methods can be used as effective tools in the UH derivation. Based on the results of this study the least squares, Laguerre and harmonic methods are probably the best methods. This is particularly true if rainfall-runoff data is subject to error. However, if the errors in data are large, the Simplex method may be the best. Also this is the only method which is capable of yielding the representative UH, whereas the other methods are not. Meixner polynomials, time series and Simplex methods can also be used as effective tools in the UH derivation. It must be noted that these conclusions are based on a small rural watershed. Whether these will be valid for a larger watershed in a different hydrometeorologic setting remains an interesting question for investigation.
W82-02803

EFFECT OF IRRIGATION ON GROUNDWATER RESOURCES WITH SPECIAL REFERENCE TO THE VAKHSH VALLEY,
All-Union Scientific-Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. A. Baron, and K. K. Bisembaeva.
Water Resources (English Translation), Vol 7, No 6, p 545-555, November/December, 1980. 1 Fig, 2 Tab, 16 Ref. Translated from Vodnye Resursy, No 6, p 120-126, November-December, 1980.

Descriptors: *Irrigation effects, *Groundwater recharge, *Hydrologic balance, Infiltration, Irrigation, Agriculture, Terracing, Groundwater management, *USSR, Vakhsh Valley.

The development of irrigated farmland causes an increase in groundwater which in turn requires increased drainage. The formation of the water balance of the Vakhsh Valley, a typical large valley in southern Tadzhikistan, was examined. Substantial changes have occurred in this semi-desert region, and a model was constructed to study the changes. It considered groundwater recharge under natural conditions, the amount of groundwater runoff into the Vakhsh River, and recent changes in groundwater runoff and recharge. In the area where irrigation was increased by 50% due to the development of additional terraces, the average value of the resultant recharge increased from 17 to 48 mm/yr. Under undisturbed conditions, natural groundwater resources were 40 mm/yr or 1.52 cu m/sec. Natural resources have been increased by the irrigation projects. (Small-FRC)
W82-02851

TIDES AND TIDAL DATUMS IN THE UNITED STATES,
Coastal Engineering Research Center, Fort Belvoir, VA.
D. L. Harris.
Special Report No 7, February, 1981. 382 p, 32 Fig, 17 Tab, 67 Ref, 3 Append.

Descriptors: *Tides, *Tidal range, *Sea level, *Elevation, Great Lakes, Tidal hydraulics, Navigation, Lakes.

This report was developed to provide engineers with a ready reference to information about tidal datums and tide characteristics, and to provide information about the statistical distribution of astronomical tidal heights which can be used in setting and measuring the elevation of proposed engineering works or combined with similar statistics for storm surges and tsunamis to estimate the probability of extreme water levels. Tidal datums of practical importance include: mean sea level, mean low water or mean lower low water for most navigation-related activities, mean high water or mean higher high water for developments of land above mean sea level, and the National Geodetic Vertical Datum (NGVD) for comparing land elevations where no tide observations are available and at interior locations where tide observations are impossible. Special datums for the Great Lakes region, based on the assumption that the mean water level in each lake defines a level surface, have been in use for more than a century. An international coordination committee adopted a Great Lakes datum called the International Great Lakes Datum (IGLD) of 1955, which has gained wide acceptance in both the United States and Canada. Statistical characteristics of the astronomical tides at various ports were investigated. The distribution function for astronomical tide heights is found to be nearly symmetric at many stations. At many other continental tide stations, the astronomical tide remains above mean sea level more than half the time, but departs farther from mean sea level in a negative rather than in a positive direction. At Honolulu, Hawaii, the predicted tide is below the mean sea level more than half the time and positive departures are larger than negative departures. (Moore-SRC)
W82-02982

2C. Snow, Ice, and Frost

LAND SURFACE AND LAKE STORAGE DURING SNOWMELT RUNOFF IN A SUBARCTIC DRAINAGE SYSTEM,
Saskatchewan Univ., Saskatoon. Dept. of Geography.
J. E. FitzGibbon, and T. Dunne.
Arctic and Alpine Research, Vol 13, No 3, p 277-285, August, 1981. 4 Fig, 3 Tab, 12 Ref.

Descriptors: *Snowmelt, *Subarctic zone, *Drainage area, *Daily hydrographs, *Surface runoff, Lakes, Runoff plot, Runoff, Watersheds, Hydrographs, Seasonal storage, Surface water, Surface drainage, Topology, Topography, Knob Lake basin, Quebec.

The hydrographs of the inflow, outflow and storage capacity of the snowmelt runoff channels of the Knob Lake Basin at Schefferville, Quebec were studied. This basin is characteristic of the complex but glacially deranged drainage systems of the Canadian Subarctic Lowlands. Lake hydrographs were taken by measuring lake storage and discharge directly for each of the lakes in the study area, while discharge hydrographs for the land surface element were determined mathematically through a water balance equation. The land surface elements were the most important component of the Knob Lake Basin drainage system due to the large storage capacity (5-15 cm) on the land surface and the 3 to 4 day delay of the runoff from the land surfaces. The hydrograph that resulted reflected seasonal rather than daily patterns in response to snowmelt runoff. (Geiger-FRC)
W82-02624

THE MASS BALANCE OF PEYTO GLACIER, ALBERTA, CANADA, 1965 TO 1978,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
G. J. Young.
Arctic and Alpine Research, Vol 13, No 3, p 307-318, August, 1981. 6 Fig, 2 Tab, 17 Ref.

Descriptors: Topography, *Hydrologic budget, *Glaciohydrology, Glacier balance, *Glacier mass balance, Mathematical studies, Ablation, Snowmelt, Glaciers, Seasonal variation, Elevation, Meteorological data collection, Annual distribution, Accumulation, Snowline, *Peyto Glacier, Alberta.

Water, ice and heat mass balance records for Peyto Glacier, Alberta for 1965 to 1978 were examined as a continuation of the studies begun during the International Hydrological Decade and International Hydrological Program. Over the entire period studied, a specific loss in mass of 0.21 m/

year water equivalent was noted, while on a year-to-year basis, slightly positive or negative balances were recorded. Both accumulation and ablation patterns were repeated yearly over short distances of the glacier, but repetitive patterns were unusual on a larger scale. Different combinations of summer ablation and winter accumulation may achieve the same net annual balance. On moderately sloping glaciers such as Peyto, the health of the glacier may be determined by the position of the transient snowline. Some relations between the net annual balance and the meteorology of the area are also discussed. (Geiger-FRC)
W82-02638

MICROWAVE MEASUREMENTS OF SNOWPACK PROPERTIES,
Kansas Univ./Center for Research, Inc., Lawrence.
W. H. Stiles, F. T. Ulaby, and A. Rango.
Nordic Hydrology, Vol 12, No 3, p 143-166, 1981. 10 Fig, 2 Tab, 44 Ref.

Descriptors: Snowpack, *Microwaves, Field tests, Remote sensing, Scattering coefficient, Water content, *Snow water equivalent, Colorado.

Active and passive microwave responses to snow parameters were measured during the winter of 1977 to correlate the data with changing snowpack properties. The study area was a hayfield near Steamboat Springs, Colorado. The three types of measurements were: temporal (daily, morning and afternoon over 6 weeks), diurnal, and snowpile (to determine the effects of piling up snow to 170 cm in 20 cm increments). The scattering coefficient and the apparent radiometric temperature were sensitive to changes in snow water equivalent and liquid water content. The scattering coefficient showed an exponential-like increase with increasing water equivalent, and the readiometric temperature, an exponential-like decrease. Increasing liquid water in the snowpack caused a decrease in scattering coefficient and an increase in radiometric temperature. These minima and maxima were seen at 4 pm, as measured by the diurnal data sets. The snow water equivalent at which the microwave response began to saturate decreased with decreasing wavelength. The scattering coefficient and radiometric temperature variations were greatest at 35 and 37 GHz, and much less at lower frequencies. This paper also reviews methods of measuring snow water equivalent and liquid water content by manual means and by microwave methods. Three basic techniques are available; bistatic reflection-coefficient measurements, measurements of snow vertical stratigraphy using high range resolution radar, and measurements of the backscattering coefficient. (Cassar-FRC)
W82-02646

QUANTITATIVE COMPOSITION, DISTRIBUTION, COMMUNITY STRUCTURE AND STANDING STOCK OF SEA ICE MICROALGAE IN THE CANADIAN ARCTIC,
Department of Fisheries and Marine Service, Ste Anne De Bellevue (Quebec). Arctic Biological Station.
S. I. C. Hsiao.
Arctic, Vol 33, No 4, p 768-793, December, 1980. 2 Fig, 5 Tab, 65 Ref.

Descriptors: *Sea ice, *Microorganisms, Algal growth, *Algae, Arctic, Polar regions, *Arctic zone, Microbiological studies, Canadian Arctic.

The quantitative composition, vertical distribution and standing stock of microalgae in Canadian arctic sea ice were investigated, and some environmental factors controlling their distribution were explored. A total of 196 species in 46 genera of microalgae was identified from the Canadian arctic sea ice. Among them the diatoms were represented by 189 species, the flagellates by 3, and the dinoflagellates and chrysophytes by 2 species each. No blue-green algae were found. Eleven, 24, and 44 species of microalgae were found exclusively in the Eskimo Lakes, Eclipse Sound and Frobisher Bay, respectively. The sea ice microalgal communities and standing stock started to develop in late fall at the time of ice formation. They grew very slowly through the winter months, increasing exponentially in early spring, reached a peak just prior to the thaw period in late spring or early summer, and declined during summer quite rapidly as the ice melting occurred. Standing stock was greatest at the bottom of the sea ice, where it was one to two orders of magnitude larger than in other parts of the ice column, and 50 to 500 times greater than in the phytoplankton in the underlying waters. The sea ice microalgae grew and spread in the continuously low temperature, variable salinities, and a quite remarkable set of light fields, together with spatially and temporally variable and discountinuous physical-chemical conditions. (Baker-FRC)
W82-02649

THE EFFECT OF WIND ON ICE PRESSURE ON RIVER STRUCTURES,
D. F. Panfilov.
Hydrotechnical Construction, No 3, p 284-289, March, 1980. 8 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 43-46, March, 1980.

Descriptors: *Ice pressure, *Hydraulic structures, *Wind velocity, Wind, Ice loads, Ice run, Estimating equations, Mathematical studies, Rivers.

The role of wind in the calculation of ice pressure on structures was explored. This depends primarily upon the relation between wind speed and current velocity. For ratios of wind speed over velocity that are less than 10 (free rivers and shallow impounded pools) the effects are small and can be ignored. For large reservoirs, the ratio is generally greater than 100 and affects the extent of the ice loads, especially during the spring ice run. Reduced equations are derived which can be used in the case of deep reservoirs with a ratio greater than 100. Movement of the ice cover in these reservoirs occurs to a considerable extent under the effect of wind. (Small-FRC)
W82-02668

ICE COVER EFFECTS ON STREAM FLOWS AND MIXING,
Canada Centre for Inland Waters, Burlington (Ontario).
Y. L. Lau, and B. G. Krishnappan.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY10, p 1225-1242, October, 1981. 12 Fig, 14 Ref.

Descriptors: *Ice cover, *Stream discharge, *Flow pattern, Mathematical studies, Turbulent flow, Flow velocity.

An alternate method was used to analyze flow structure in an ice covered stream. A turbulence model (Launder and Spalding) was used to calculate the depth, velocity distribution, the bed slope, and bottom roughness. Then these results were used in the two-dimensional mass transport equation to simulate concentration distributions due to sources placed at different heights in the flow. Three different fully developed flows were calculated for open water and ice covered conditons. The equivalent ice-covered flows had larger flow depths and smaller bed shears than the free-surface flows. The resulting eddy viscosity was smaller; however, it did not go to zero. When a neutrally buoyant tracer was computed for all runs, the distributions indicated reduced mixing rates in ice-covered flows when compared to open-water flows. (Small-FRC)
W82-02698

PRODUCTION STRATEGIES IN ANTARCTIC INLAND WATERS: PHYTOPLANKTON ECOPHYSIOLOGY IN A PERMANENTLY ICE-COVERED LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
W. F. Vincent.
Ecology, Vol 62, No 5, p 1215-1224, October, 1981. 5 Fig, 6 Tab, 32 Ref.

Descriptors: *Phytoplankton, *Ice cover, *Antarctic, Polar regions, Lakes, Lake ice, Primary productivity, Nutrients, Temperature effects, Light penetration.

The relative importance of light, temperature, and nutrient supply for strategies of primary production by antarctic phytoplankton was examined experimentally in Lake Fryxell, a relatively productive water in the Taylor Valley (South Victoria Land). The lake is permanently covered by 3.8-4.6 m of ice and is 7 sq km in area. Three distinct layers of algal production were distinguished. Immediately under the ice, phytoplankton were adapted to relatively bright light and were limited by nitrogen availability. There was a deep maximum of Chroomonas and Pyramimonas at the bottom of the eutrophic zone in a highly shaded area. Mid-eutrophic populations continued to grow throughout midsummer. Nutrient supply seemed to determine lake-to-lake and depth variations in primary productivity when results from several lakes were compared. Low light rather than low temperature damped algal photosynthesis. (Small-FRC)
W82-02862

A SOLUTION TO SPRING ICE-JAM FLOODING,
J. C. Loffredo.
Public Works, Vol 111, No 3, p 82-83, March, 1980.

Descriptors: *Ice jams, *Ice breakup, *Flood control, *Flood protection, Flooding, Regional floods, Floodproofing, Streamflow, Streams, *Cazenovia Creek, Buffalo, New York.

To alleviate spring ice-jam flooding on Cazenovia Creek, the city of Buffalo employs three World War II vehicles (LVTs) to act as small ice breakers. To aid in the ice breaking efforts where dynamite has failed, track powered, amphibious LVTs were developed that could operate in only 5 feet of water. These modified vehicles are 27 feet long by 10 feet wide and can handle ice up to 2 feet thick. When used in conjunction with dynamite, the new LTVs can break ice up to 5 feet thick. Sometimes a large stationary ice field will cause flooding on Cazenovia Creek. The LVTs are used in breaking up the ice field before the heavy spring runoff to prevent the flooding before it has a chance to occur. Two of these new vehicles were used to break ice fields on Owasco Outlet, Port Byron, a non-navigable stream downstream from a dam whose reservoir was in danger of topping. During the Port Byron mission their lack of power and speed in reverse caused the LVTs to become stuck in the ice field. Federal grants are being sought to design new transmissions for the vehicles to overcome this problem. (Geiger-FRC)
W82-02908

2D. Evaporation and Transpiration

STOMATAL RESPONSE TO ENVIRONMENTAL VARIABLES IN TWO TROPICAL FOREST SPECIES DURING THE DRY SEASON IN NIGERIA,
Ibadan Univ. (Nigeria). Dept. of Forest Resources Management.
D. Whitehead, D. U. U. Okali, and F. E. Fasehun.
Journal of Applied Ecology, Vol 18, No 2, p 571-587, August, 1981. 10 Fig, 2 Tab, 30 Ref.

Descriptors: *Stomatal transpiration, *Water potentials, *Forest hydrology, Transpiration, Leaves, Teak, Gmelina, Trees, *Nigeria, Plant water potential, Tropical regions, Soil-water-plant relationships.

The stomatal responses of two fast-growing exotic trees of commercial value were determined as part of a study on prediction of transpiration rates. Gmelina arborea Roxb. is planted for pulpwood, and teak (Tectona grandis L.), for poles and saw timber. A null-balance diffusion porometer was used to measure stomatal conductance on 6 days during the dry season, January 1978, near Ibadan, Nigeria. In both species stomatal conductance increased rapidly in early morning from a low of 2.0-2.5 mm per sec and decreased after midday. Maxi-

mum Gmelina values (10-15 mm per sec) were less than those for teak (20-30 mm per sec). Generally, stomatal conductance increased with increasing irradiance and decreased with increasing air saturation deficit. Maximum conductances were at 400 and 800 micro Einstein per sq meter per sec in Gmelina and teak, respectively. Although temperature effects were not altogether clear, there was indication that conductances were higher at 20-28 C for Gmelina and 27-31 C for teak. There was no evidence that leaf water potential and conductance were related. Transpiration rates calculated from the Penman-Monteith equation using observed stomatal conductances and environmental variables agreed closely with transpiration rates calculated from conductances predicted by the Jarvis (1976) model. Mean hydraulic resistances were (in MPa per m): Gmelina, 6 million, and teak, 5.3 million. (Cassar-FRC)
W82-02884

THE IRRIGATION SCHEDULING PROBLEM AND EVAPOTRANSPIRATION UNCERTAINTY,
Massachusetts Inst. of Tech., Cambridge.
A. E. Rhenals, and R. L. Bras.
Water Resources Research, Vol 17, No 5, p 1328-1338, October, 1981. 11 Tab. 29 Ref.

Descriptors: *Evapotranspiration, *Model studies, Mathematical models, Consumptive use, *Irrigation practices, Irrigation, Crop yield.

The purpose of this paper is to present an optimization model for scheduling in which the natural uncertainty of potential evapotranspiration (PET) has been explicitly included. A hypothetical case study is presented in order to gain insight into the behavior of the global model, to determine its computational feasibility, and to provide an example of the effect of PET uncertainty on the measures of performance of irrigation scheduling. The model presented is based on stochastic dynamic programming and is formulated to maximize net benefits from a crop facing uncertain, correlated evapotranspiration demands. Weekly irrigation decisions are made after observing current soil moisture and available irrigation water, as well as PET during the past week. The model is similar to the traditional reservoir control algorithms popular in the surface water investigations. Although the model formulation is useful and feasible, the case study example points out that the effect of uncertain evapotranspiration on irrigation performance measures is apparently minimal. Computer programs used for this analysis are available. A major limitation of the global model was seen to be that the crop model utilized has not been field tested. (Baker-FRC)
W82-02900

2E. Streamflow and Runoff

HOW ABIOTIC FACTORS AFFECT THE DISTRIBUTION OF TWO SPECIES OF TROPICAL PREDACEOUS AQUATIC BUGS (FAMILY: NAUCORIDAE),
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
For primary bibliographic entry see Field 7A.
W82-02633

RIVER AND SUSPENDED SEDIMENT DISCHARGE INTO BYAM CHANNEL, QUEEN ELIZABETH ISLANDS, NORTHWEST TERRITORIES, CANADA,
Pacific Geoscience Centre, Sidney (British Columbia).
P. McLaren.
Arctic, Vol 34, No 2, p 141-146, June, 1981. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Sediment transport, *Alluvial channels, Channels, Suspended sediments, Runoff, Catchment areas, Drainage, Arctic zone, Arctic, Alluvial deposits, Ice, Cold regions, *Northwest Territories, Canada.

River and suspended sediment discharge into Byam Channel, which intervenes between the eastern Melville and western Byam Martin islands in the Northwest Territory of Canada, was investigated during 1973 and 1974. There are 32 drainage basins on the two coasts, of which seven enter Viscount Melville Sound, three flow north into Byam Martin Channel, and the other 22 empty into Byam Channel. They range in size from 11 square kilometers to 1136 square kilometers, each basin discharging onto a delta that begins at the point where the river is no longer confined within valley walls and is characterized by a braided stream pattern. Continuous ice persists in Byam Channel for at least 9 months of the year. River sediments are frequently deposited on nearshore ice during breakup, resulting in a decreased albedo and a more rapid melting at the delta fronts. Flow and suspended sediment discharge were measured 15 times between 30 June and 1 August 1974. Stream flow began on 29 June. On 1 July discontinuous sand was being deposited on an ice stream bottom, and by 3 July the stream had cut down to the channel bottom. Peak discharge occurred on 10 July and by 16 July no snowbanks remained. From 30 June to 6 July suspended sediment concentration increased steadily with increasing discharge, peaking at 3.36 kg/cubic meter and dropping by 16 July to 0.44 kg/cubic meter. Much of the sediment is apparently not deposited in the channels, but rather is incorporated into the active delta fronts or possibly transported out of Byam Channel above a pycnocline. (Baker-FRC)
W82-02637

MODELING CIRCULATION IN DEPTH-AVERAGED FLOW,
San Diego State Univ., CA. Dept. of Civil Engineering.
V. M. Ponce, and S. B. Yabusaki.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1501-1518, November, 1981. 5 Fig, 15 Ref.

Descriptors: *Circulation, *Model studies, Mathematical studies, Turbulence, Flow, Hydrodynamics, Channels, *Open channels, Multiphase flow, Water circulation.

A fundamental investigation of the circulation phenomena in open channels is performed using a depth-average mathematical model. Circulation has been observed to have a primary influence on erosion and accretion processes, heat diffusion, and contaminant dispersion. Therefore, the clarification of the physical mechanisms leading to the generation of circulation in free surface flow is a much needed endeavor. The depth-averaged two-dimensional governing equation set is used as a basis for the development of a finite difference model employing a multi-operational procedure to advance the values of the dependent variables in time. Two geometric onfigurations are extensively tested regarding the mathematical model itself and the boundary conditions. It was found that proper modeling of the effective stresses is a necessary condition for the resolution of steady, closed-streamline circulation in depth averaged mathematical models. Additionally, a competition exists between convective inertia and bed resistance. Circulating flow is inhibited when bed resistance predominates. The type of boundary condition specification is found to have a significant effect in the resulting flow pattern. It is noted that the greatest source of uncertainty in such studies is the modeling of the effective stresses. It is surmised that a higher level of sophistication is needed to handle complex flow patterns. A separate account of the three components of the effective stresses may be warranted. At present, individual closure assumptions are not available. (Baker-FRC)
W82-02679

ICE COVER EFFECTS ON STREAM FLOWS AND MIXING,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2C.
W82-02698

ANALYSIS OF FLOOD HYDROGRAPHS FROM WETLAND AREAS,
For primary bibliographic entry see Field 2A.
W82-02733

LOCAL FLOW ACCELERATIONS IN RIVERS,
Canterbury Univ. Christchurch (New Zealand). Dept. of Agricultural Engineering.
B. D. Van't Woudt.
Water Resources Bulletin, Vol 17, No 4, p 571-577, August, 1981. 7 Fig, 2 Tab, 8 Ref.

Descriptors: *Rivers, *Flow rates, *Alteration of flow, Flow characteristics, Fluctuations, Streamflow, Braided rivers, *New Zealand, Flow control, Roughness, Flow accelerations.

A field study of local flow accelerations in rivers was undertaken to provide background information for the control of many braided rivers in New Zealand. The study area was 3000 m x 800 m along the floodplain of the Waimakariri river. Flow accelerations were found to form sequentially on the downstream face of a bar across a channel when the bar approached a given water surface grade line. The bar formation occurred within a pattern of deep and shallow subreaches that can coincide with narrow and wide ones. Also, nonsequential flow accelerations can be induced by a bankslide or be formed through channel capture, channel abandonment, or channelslide deposits. Flow accelerations can be intensified through time, and can be obliterated by washout or sediment swamping. (Small-FRC)
W82-02758

CHANNEL FORM AND FLOW CHARACTERISTICS OF SUPRAGLACIAL STREAMS, AUSTRE OKSTINDBREEN, NORWAY,
Sheffield Univ. (England). Dept. of Geography.
A. D. Knighton.
Arctic and Alpine Research, Vol 13, No 3, p 295-306, August, 1981. 6 Fig, 1 Tab, 27 Ref.

Descriptors: *Streamflow, *Glacial streams, *Flow velocity, *Flow discharge, Rapid flow, Alluvial plains, Alluvial rivers, Flow pattern, Stream discharge, Topography, Water depth, Ablation, Glaciohydrology, Comparison studies, *Norway.

The characteristics of supraglacial streams and the similarity in behavior of these streams to those in alluvial environments were studied in three streams of the ablation area of Austre Okstindbreen, Norway. Two supraglacial streams were found to adjust their width and depth nearly equally but increase their velocity at the highest rate in response to a rapid downstream increase in discharge. A stream with a less regular pattern of downstream discharge showed similar width adjustments but different depth and velocity responses. The downstream relations of the first two streams differed from alluvial streams, showing responses which might be expected in the absence of declining slope and sediment load. Fluctuations in streamflow behavior were attributed in part to bed topography. The supercritical flow which aids in meander formation is related to the generation of traveling waves in one stream, with significant differences in wave frequency in various parts of the stream. (Geiger-FRC)
W82-02787

THE RELATION BETWEEN 'HYDRAULIC STRESS' AND MICRODISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN A LOWLAND RUNNING WATER SYSTEM, THE SCHIERENSEEBROKS (NORTH GERMANY),
Karlsruhe Univ. (Germany, F.R.) Inst. fuer Zoologisches.
For primary bibliographic entry see Field 5C.
W82-02790

MATHEMATICAL MODELS OF WATER YIELD WITH PARTICULAR REFERENCE TO MISSISSIPPI WATERSHEDS: INTERIM REPORT NO. 1, A STUDY OF SOME EMPIRICAL METHODS OF DETERMINING THE UNIT HYDROGRAPH,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 2A.
W82-02803

LOW-FLOW CHARACTERISTICS OF KENTUCKY STREAMS, 1980,
Geological Survey, Louisville, KY. Water Resources Div.
J. N. Sullavan.
Geological Survey Open-File Report 80-1225, 1980. 1 Sheet, 2 Fig, 2 Ref.

Descriptors: *Low flow, *Base flow, *Flow characteristics, Surface water, *Streamflow, Hydrologic data, Gaging stations, Sites, *Kentucky, Log-Pearson type III.

The low-flow characteristics, including the 7-day 2-year and the 7-day 10-year low flows, were determined at 127 stations in Kentucky. The log-Pearson type III distribution was used to fit the field data, from which low-flow frequencies were obtained. An additional 127 sites are active throughout the State. (USGS)
W82-02826

LOW-FLOW FREQUENCY DATA FOR SELECTED STREAM-GAGING STATIONS IN FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. H. Hughes.
Geological Survey Open-File Report 81-69 (WRI), 1981. 110 p, 17 Fig, 2 Ref.

Descriptors: *Low flow, Data collections, *Streamflow, *Flow rates, Frequency analysis, Average flow, Gaging stations, Sites, *Florida, Low-flow frequency, Recurrence interval.

This report contains tables of low-flow frequency data for 161 stream-gaging stations in Florida. The selected stations represent those having suitable flow records spanning 7 or more years. Flow values representing the annual minimum average flow for selected periods ranging from 1 to 183 days are presented for recurrence intervals ranging from 2 to 50 years. The low-flow frequency data of relatively short-term stations were adjusted where possible on basis of records of long-term stations to reduce the possible bias introduced by short-term climatic trends. (USGS)
W82-02834

DRAINAGE AREAS OF STREAMS AT SELECTED LOCATIONS IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W82-02835

FLOW DURATION AT SELECTED STREAM-SITES IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
F. Quinones, J. Kiesler, and J. Macy.
Geological Survey Open-File Report 80-1221, 1980. 143 p, 3 Fig, 5 Ref.

Descriptors: *Flow duration, *Flow characteristics, *Frequency analysis, *Streamflow, Hydrologic data, Regulated flow, Runoff forecasting, Gaging stations, Sites, *Kentucky, Natural flow.

Flow duration characteristics were determined for 195 streamflow stations in Kentucky. The data includes flow duration tables for the period of record of the stations based on mean daily discharges. Seasonal flow durations are also presented from monthly analysis of the data. At sites affected by regulation, tables are published showing both the before and after regulation flow duration data. (USGS)
W82-02837

DISCHARGE CHARACTERISTICS OF TRIANGULAR-NOTCH THIN-PLATE WEIRS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 8B.
W82-02842

SPACE-TIME VARIABILITY OF THE RUNOFF OF EUROPEAN RIVERS,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
A. K. Fomchenkov.
Water Resources (English Translation), Vol 7, No 6, p 500-509, November/December, 1980. 3 Fig, 3 Tab, 13 Ref. Translated from Vodnye Resursy, No 6, p 52-63, November-December, 1980.

Descriptors: *Water level fluctuations, *Rivers, *Correlation analysis, Mathematical studies, *Runoff, Hydrologic data collections, *Europe, Temperature effects, Stream flow, River basins.

Space-time variability of European rivers was studied using data on runoff collected at 89 gaging stations of which 50 have an observation period greater than 70 years. The change in correlation coefficients was analyzed as a function of the duration of the investigated runoff series. There were small variations of the correlation coefficients over the 60-year period, 1911-1970. This technique was used to isolate regions with synchronous variations, and 14 regions were determined using a minimum intraregional correlation greater than or equal to 0.4. To determine large territories with similar runoff variations, five areas with a positive runoff correlation were isolated on the basis of an analysis of the correlation matrix. When atmospheric circulation indices were studied, the maximum relation in 12 of the 14 regions was observed either with purely western circulation indices or with western circulation indices in combination with the southern circulation index. (Small-FRC)
W82-02848

HYDRAULIC RESISTANCE OF FLOODPLAINS,
Odessa State Univ. (USSR).
Y. N. Sokolov.
Water Resources (English Translation), Vol 7, No 6, p 563-572, November/December, 1980. 3 Fig, 2 Tab, 24 Ref. Translated from Vodnye Resursy, No 6, p 143-154, November-December, 1980.

Descriptors: *Flood plains, *Flood flow, *Terrain analysis, *Roughness coefficient, Flow, Mathematical models, Vegetation effects, Topography, Hydrology, Hydraulic roughness, Hydraulic resistance.

Calculation of the roughness coefficient for floodplains and determination of the hydraulic resistance of floodplains are outlined. The hydraulic resistance determines the characteristics of flow and depends mainly on the standard deviations of averaged elevations in the direction of the flow. It also depends on functions characterizing the correlation between the elevations of the relief along the flow but averaged in a transverse direction. An example of such a description of a floodplain is presented. A statistical model of vegetation can be constructed by analogy with the representation of the floodplain relief as a random field of heights. The main dimensions of the plants depend upon whether they are single or multi-trunked. Data from aerial photographs and ground topography and botanical information can be used to construct parameters characterizing the roughness of relief and vegetation of a floodplain. (Small-FRC)
W82-02850

CALCULATION OF THE ANNUAL DISTRIBUTION OF RIVER RUNOFF WHEN OBSERVATION DATA ARE AVAILABLE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
E. G. Ivanov.
Water Resources (English Translation), Vol 7, No 6, p 510-515, November/December, 1980. 2 Fig, 1 Tab, 5 Ref. Translated from Vodnye Resursy, No 6, p 64-70, November-December, 1980.

Descriptors: *Water level fluctuations, Rivers, *Mathematical studies, Probability distribution, High water mark, Low water mark, Runoff, *USSR, *Streamflow, *Annual distribution.

A method which is a refinement of the standard Andreyanov technique for determining the annual distribution of river runoff is presented. The new method selects more than two high and low water periods during the year if this is appropriate. The available series of runoff observations is divided into annual time intervals starting from the wettest (driest) month according to long-term data. Empirical probability distribution curves are plotted, and month minima (maxima) and annual minima (maxima) are determined. The method was checked using water data, and good agreement was found. The method overcomes the problem of the Andreyanov technique which divided the years into common hydrologic periods and seasons, when the actual duration of hydrologic periods and seasons varies rather widely from year to year. The new method can give more accurate results. (Small-FRC)
W82-02854

FLOW RESISTANCE IN COARSE GRAVEL BED RIVERS,
Ministry of Works and Development, Christchurch (New Zealand).
For primary bibliographic entry see Field 2J.
W82-02879

STOCHASTIC HYDROLOGIC MODEL FOR DROUGHT MANAGEMENT,
Geological Survey, Reston, VA. Water Resources Div.
R. M. Hirsch.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 303-313, October, 1981. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Drought, *Streamflow forecasting, *Stochastic process, Model studies, Hydrologic models, Water supply, Reservoir storage, *Potomac River, Rivers, Forecasting, Risks, Water management.

The ARMA (1,1) cyclic stochastic flow model was used to produce long range water supply forecasts. It generates conditional cumulative distribution functions for monthly streamflow volumes and produces a set of equiprobable streamflow traces. With this information the conditional distribution functions of reservoir storage can be evaluated for a future month, and the probability of storage falling below a given level can be forecast. The 81-year streamflow record at Point of Rocks, Maryland, was used to illustrate the model. The ARMA (1,1) cyclic model was the best of a group of six models fit to the data. The second-ranking model was ARMA (1,0) cyclic. Four ARMA stationary models, fit using maximum likelihood estimation, were less satisfactory. (Cassar-FRC)
W82-02897

REGIONALIZATION AND PREDICTION OF ANNUAL FLOODS IN THE FRASER RIVER CATCHMENT, BRITISH COLUMBIA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
P. Waylen, and M-K. Woo.
Water Resources Bulletin, Vol 17, No 4, p 655-661, August, 1981. 3 Fig, 20 Ref.

Descriptors: *Flood forecasting, *Mathematical studies, Flood control, Forecasting, *Fraser River Catchment, Canada, *British Columbia, Rivers.

A method is presented for predicting probability distributions of annual floods. The method is applied to the Fraser River catchment area of British Columbia. The technique of discriminant analysis provides a statistical distinction between two or more groups of basins affected by different flood generating processes such as snowmelt, glacier melt or rainfall. These groups are considered as hydrologic regions of differing flood characteristics. In this study discriminant functions are obtained using the means and standard deviations of the flood series, since both measures are related to the parameters alpha and beta of the Gumbel distribution. At the initial trial for regionalization, individual basins are assigned to different regions a priori, and the discriminant functions are computed using a program from the Statistical Package for

the Social Sciences. This program calculates the probabilities that a basin should be assigned to each of the a priori regions. The regions are thus reconstituted to obtain a new set of discriminant functions. Subsequently the basins are located on a map, and their disposition allows the regions to be delineated. The method was applied to the Fraser catchment, above the town of Hope, covering an area of 217,000 square kilometers. The two-parameter Gumbel distribution sufficiently described the annual floods of the selected rivers in this catchment. Through stepwise regression major climatic and physiographic variables can be identified in various regions, and the resulting equations successfully predict the flood characteristics for basins within the region. (Baker-FRC)
W82-02910

CONSTRUCTION OF A GAMMA-DISTRIBUTION PROBABILITY PAPER FOR STRAIGHTENING DISCHARGE PROBABILITY CURVES,
For primary bibliographic entry see Field 7B.
W82-02925

2F. Groundwater

ESTIMATION OF CALCIUM SULFATE SOLUTION RATE AND EFFECTIVE AQUIFER SURFACE AREA IN A GROUND-WATER SYSTEM NEAR CARLSBAD, NEW MEXICO,
Geological Survey, Lakewood, CO.
H. C. Claassen.
Ground Water, Vol 19, No 3, p 287-297, May/June, 1981. 4 Fig, 5 Tab, 7 Ref.

Descriptors: *Calcium sulfate, *Solubility, *Aquifer characteristics, Hydraulic conductivity, Leakage, Pecos River, Lake McMillan, Brantley Dam, *New Mexico, Reservoirs, Geohydrology, Minerals, Dissolved solids, Recharge, Groundwater recharge, Gypsum, Anhydrite, Water quality, Chemical composition, Groundwater movement, Dam stability, Dam effects.

Leakage from Lake McMillan, New Mexico, has raised question about the ability of the proposed Brantley Dam, downstream, to hold water. These sites are in a region of evaporite facies, consisting mainly of gypsum and anhydrite. The formation has a large hydraulic conductivity, 2 million meters per day. Major recharge is from the Pecos River. The minimum amount of calcium sulfate being dissolved at present, about 6 millimol per liter, was calculated from differences in the chemical composition of the water recharging the system and the composition of the groundwater in the system. The total mass of calcium sulfate dissolving is 29 times 10 to the 10th power g per year (volume, 9900 cu m as anhydrite or 16,000 cu m as gypsum) at a minimum flow of 1.13 cu m per sec. All computations depend on the accuracy of the uncertain value of the equilibrium constant for gypsum. The estimated ratio of aquifer gypsum surface area to groundwater volume is very small, indicating that the hydraulic conductivity is secondary (fracture or conduit). These conduits widen at rates of a few tens of mm per year. If the Brantley Dam is built, changes in hydrology could result. The degree of change is dependendent on the location of the dam site, the quality of water impounded in the reservoir, effects of reservoir filling on hydraulic gradients, and the amount and distribution of calcium sulfate minerals in the currently unsaturated zone. This study cannot answer the question of whether potential increases in gypsum removal rate would threaten the stability of the Brantley Dam. (Cassar-FRC)
W82-02612

ATOLL ISLAND HYDROLOGY,
Nevada Univ. System, Reno, NV. Desert Research Inst.
S. W. Wheatcraft, and R. W. Buddemeier.
Ground Water, Vol 19, No 3, p 311-320, May/June, 1981. 6 Fig, 3 Tab, 26 Ref.

Descriptors: *Atolls, *Tidal effects, *Aquifer systems, Geohydrology, Groundwater movement, Model studies, Mathematical models, Enewetak Atoll, *Marshall Islands, Enjebi Island, Unconsolidated aquifers, Carbonate aquifers.

An important feature of atoll groundwater hydrology in the northern Marshall Islands is vertical coupling between the unconsolidated Holocene surface aquifer and an underlying, more permeable Pleistocene limestone aquifer at a depth of several tens of meters. Tidal lag, tidal efficiency, and water levels were measured in 24 wells, 1 to 90 m deep, on Enjebi Island on Enewetak Atoll. Hydraulic conductivity measurements were obtained from laboratory and field testing. Data were used in a model based on horizontal propagation of tidal signals. Results indicated that horizontal transport and tidal signal propagation were not operative in this region. This agreed with results from other atoll islands in the area. A simple mathematical model of groundwater dynamics based on the assumption of one-dimensional radial flow and tidal boundary conditions was developed. The implications of the vertical transport mechanism are: (1) fresh water reserves are more limited than predicted, (2) water reserves recover more quickly from overexploitation or contamination, (3) radionuclides are carried downward into the deeper aquifers instead of horizontally toward the sea, and (4) a deep transition zone with a high throughout of fresh and salt water may be important for rates and mechanisms of diagenetic changes in the sediments. (Cassar-FRC)
W82-02617

GEOELECTRIC SOUNDINGS FOR PREDICTING AQUIFER PROPERTIES,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. K. Kosinski, and W. E. Kelly.
Ground Water, Vol 19, No 2, p 163-171, March/April, 1981. 5 Fig, 3 Tab, 39 Ref.

Descriptors: *Transmissivity, *Aquifer properties, *Resistivity, *Rhode Island, Electrical properties, Permeability, *Glacial aquifers, Aquifer characteristics.

A study was conducted to develop surface resistivity techniques for making quantitative estimates of the water transmitting properties of glacial outwash materials. Two bedrock valleys filled with glacial outwash material and located in the Pawcatuck River Basin, Rhode Island, were investigated with Schlumberger resistivity soundings. Data from previous pumping tests were also available. Resistivities for the different aquifer materials were derived with boring log control. The auxiliary point methods were used to reduce the aquifer layering to a single representative resistivity value. Electrical properties of individual layers within the aquifer cannot be obtained without bore hole control because of equivalence and suppression. The relation between normalized resistivity and permeability observed in this study is opposite to what has been observed in some earlier laboratory studies and is attributed in part to the high resistivity of the ground water. Relationships derived between aquifer hydraulic and electrical properties were applicable only to this area. However, the methodology is useful for other situations. (Cassar-FRC)
W82-02619

BOISE LOOKS UNDERGROUND FOR HEAT.
American City and County, Vol 95, No 8, p 59-61, August, 1980. 1 Fig, 1 Tab.

Descriptors: *Geothermal resources, *Heating, *Wells, *Boise, Idaho, Energy sources, Groundwater mining, Injection wells.

Geothermal water will be used to heat 1 million sq ft of space in commercial and municipal buildings in Boise, Idaho, after completion of a $16.1 million geothermal resources development project. The Warm Springs Water District and the Boise Water Corporation will drill seven production wells and extend and renovate present pipe systems. Wells will be 14 inches in diameter and about 1200 ft below the surface, with a planned production rate of 800-1500 gpm per well. Pumps will be continuous-duty vertical turbine pumps capable of operating with 170F water. The supply main will be 16 inches diameter preinsulated asbestos-cement pipe. The collection line, between 12 and 18 inches in diameter, will run parallel to the supply main to injection wells. Water will enter buildings at about 165F and leave at about 120F, providing 80% of total heating needs. Fixed operating costs will be $132,500 in 1982 and rise to $235,800 by 1990. Energy costs per therm (100,000 BTU) will be 28.1 cents in 1982, 38.1 cents in 1995, and drop to 29.2 cents in 2000 after debts are paid. (Cassar-FRC)
W82-02636

INTEGRAL EQUATION FORMULATION FOR GROUND-WATER FLOW,
Canterbury Univ., Christchurch (New Zealand).
B. Hunt, and L. T. Isaacs.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY10, p 1197-1209, October, 1981. 8 Fig, 10 Ref.

Descriptors: *Groundwater movement, *Estimating equations, *Porous media, Flow velocity, Computers, Mathematical studies.

An alternative integral equation formulation for the two-dimensional mixed problems of groundwater flow was investigated. This formulation yields a simultaneous set of integral equations with boundary values of the velocity potential and the stream function as unknowns. This method, based on the Cauchy integral theorem, can be used in a general purpose computer program for the analysis of multizone, anisotropic, two-dimensional flows in porous media. The formulation is simple and compact and leads to a well-conditioned set of equations. It allows nodes to be closely spaced in the region of singularities. The computer program has many practical applications. (Small-FRC)
W82-02716

ANALYSIS OF PUMPING TEST DATA USING MARQUARDT ALGORITHM,
Indian Inst. of Tech., New Delhi. Dept. of Civil Engineering.
S. Chander, P. N. Kapoor, and S. K. Goyal.
Ground Water, Vol 19, No 3, p 275-278, May/June, 1981. 2 Tab, 6 Ref.

Descriptors: *Marquardt algorithm, *Aquifer characteristics, *Pumping tests, Algorithms, Groundwater movement, Mathematical studies, Drawdown, Leaky aquifers, Graphical analysis, Transmissivity.

The Marquardt algorithm was the best method of estimating aquifer parameters from pump test data in a comparison of several methods. The residual square error was smaller than that obtained by known methods: theis curve, Jacob, Chow, and Kirz for nonleaky aquifers, and Hantush I, Walton's curve, and Rushton's discrete numerical model for leaky aquifers. The Marquardt algorithm is not sensitive to initial estimates, and convergence is fast. This method also avoids the subjectivity of the conventional graphical techniques. (Cassar-FRC)
W82-02721

GROUNDWATER SYSTEMS ASSOCIATED WITH SECONDARY SALINITY IN WESTERN AUSTRALIA.
Western Australia Dept. of Agriculture, South Perth. Div. of Resource Management.
R. A. Nulsen, and C. J. Henschke.
Agricultural Water Management, Vol 4, No 1/3, p 173-186, 1981. 7 Fig, 3 Tab, 41 Ref.

Descriptors: *Salinity, *Groundwater, *Surface-groundwater relations, *Australia, Soil properties, Salts, Hydrology, Water pollution sources, Groundwater movement, Aquifer characteristics, Geochemistry.

The Western Australian landscape is characterized by a peneplain developed by subaerial weathering of Archean rocks. Except on the margins of the peneplain, surface drainage is limited to a series of interconnected salinas, and subsurface drainage is restricted by a relatively shallow, impermeable

bedrock and an absence of sedimentary aquifers. The simplest model of a catchment consists of an intake area, a flow path and a discharge area. Information currently available about each of these three major components is reviewed. Skeletal soils often are present immediately below rock outcrops, and it is supposed that these areas are recharge zones for the confined aquifer in the Belka Valley. Relatively high infiltration rates measured in the upper pediments indicate that these areas may act as preferential intake areas for the seepages that occur downslope. The flow path in most of the groundwater systems in Western Australia consists of a shallow unconfined aquifer and a deeper semi-confined aquifer. The thickness of the aquifers varies with the surface topography and contours of the bedrock. In most cases the length of the flow path is much greater than the thickness. Only a few measurements have been made of the transmission characteristics of aquifers associated with land and stream salinity in Western Australia. The discharge of saline water from the groundwater system can take place either by flow into a stream system or by capillary rise and subsequent evaporation from the soil surface. Subsurface water flow in discrete channels in the discharge area is a common observation. The occurrence of secondary soil salinity is usually associated with a rise in the level of the water table, and only by reversing the trend and significantly reducing the level of the water table can any amelioration of surfce salinity be achieved. (Baker-FRC)
W82-02770

GROUND-WATER RECHARGE FROM RECTANGULAR AREAS,
Indian Agricultural Research Inst., New Delhi (India). Water Technology Center.
N. H. Rao, and P. B. S. Sarma.
Ground Water, Vol 19, No 3, p 271-274, May/June, 1981. 2 Fig, 8 Ref.

Descriptors: *Water table profiles, *Confined aquifers, *Groundwater recharge, Aquifers, Unconfined aquifers, Prediction, Equations, Groundwater mound profiles.

An analytical solution for the formation of groundwater mounds beneath rectangular recharge areas for finite aquifers has been developed. Data of Bianchi and Haskell (1975) for the same situation in infinite aquifers was used in the equation after fixing boundaries at large, but finite, distances. The predicted groundwater mound profiles generally agree well with the observed profiles. During initial recharge (5.15 days) the predicted profile is above the observed profile at all distances from the center to the limit studied, 300 ft. At higher values of time (25 days) and distances close to the center (0.175 ft) the predicted profile is lower than the observed profile. At higher values of time (25 days) and distances greater from the center (175-300 ft) the predicted profile is slightly higher than the observed profile. The Glover equation for infinite aquifers gives results about a foot higher than observed values under all conditions of time and distance from the center. Differences between profiles obtained from the method developed in this paper and the observed profiles are on the order of 0.5 ft. (Cassar-FRC)
W82-02791

PROBABLE HIGH GROUND-WATER LEVELS IN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
M. H. Frimpter.
Geological Survey Open-File Report 80-1205 (WRI), March, 1981. 19 p, 12 fig, 1 Tab, 7 Ref.

Descriptors: Groundwater, *Water table, *Observation wells, Water level fluctuations, Estimating, *Massachusetts, *Groundwater level.

Water-level records from an observation-well network are analyzed for utility in estimating probable high ground-water levels in three different geohydrologic environments in Massachusetts. Analyses were made of 83 observation wells with between 8 and 37 years of records. Maximum annual water levels occur most frequently in March and April. The maximum range of water levels equaled or exceeded at 10 percent of randomly selected sites is estimated to be 16 feet in till, 9.2 feet in sand and gravel on terraces, and 4.0 feet in sand and gravel in valleys. An approach to estimating probable high ground-water levels at construction sites is suggested. An estimate of the high water level at a site may be derived by solving the proportion in which the ratio of the potential water-level rise at a test site to the potential water-level rise at an observation well is equal to the ratio of the water-level range at the site to the historic water-level range at an observation well in a similar geohydrologic environment. Precise description of the probabilities of exceedence of estimates made by this approach with the data available has not been made. Assuming that the data are representative of the future, estimates would not be expected to be exceeded at more than 1 in 10 sites over a period of 10 years or longer. (USGS)
W82-02829

GEOLOGY AND WATER AVAILABILITY OF DALLAS COUNTY, ALABAMA,
Geological Survey, Univ., AL. Water Resources Div.
For primary bibliographic entry see Field 6D.
W82-02833

DIGITAL-MODEL SIMULATION OF THE HYDROLOGIC FLOW SYSTEM, WITH EMPHASIS ON GROUND WATER, IN THE SPOKANE VALLEY, WASHINGTON AND IDAHO,
Geological Survey, Tacoma, WA. Water Resources Div.
E. L. Bolke, and J. J. Vaccaro.
Geological Survey Open-File Report 80-1300 (WRI), 1981. 43 p, 16 Fig, 21 Ref.

Descriptors: *Mathematical models, *Groundwater, Flow system, *Aquifer, Aquifer characteristics, Wells, Hydrologic data, Geohydrology, Precipitation, Evapotranspiration, Pumping, *Groundwater movement, Water level fluctuations, Hydraulic conductivity, Surface-groundwater relations, *Washington, *Idaho, Spokane Valley.

A digital-computer model of the hydrologic flow system, with emphasis on ground water, was developed for the Spokane Valley, Washington and Idaho. The current rate of ground water pumping has little effect on water levels in the Spokane aquifer, although short-term water-level declines occur locally. The model was used to show the effects of increased ground-water pumping on aquifer heads and streamflow. Increasing the pumping rates, by a factor of 2 from the 1977 rates, lowered water levels in the Spokane aquifer less than 3 feet during a 1-year simulation. Doubling the ground-water pumping caused a decrease in discharge of the Spokane River, as measured at Spokane, of about 150 cubic feet per second during the summer months and about 50 cubic feet per second during the rest of the year. The leakage from the aquifer to the Little Spokane River was decreased by less than 10 cubic feet per second by doubling the ground-water pumping. (USGS)
W82-02836

GROUND-WATER APPRAISAL OF SAND PLAINS IN BENTON, SHERBURNE, STEARNS, AND WRIGHT COUNTIES, CENTRAL MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
G. F. Lindholm.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $28.75 in paper copy, $5.50 in microfiche. Geological Survey Open-File Report 80-1285 (WRI), 1980. 103 p, 49 Fig, 4 plates, 12 Tab, 32 Ref.

Descriptors: *Groundwater, *Aquifers, *Groundwater availability, *Aquifer charcteristics, Sand aquifers, Groundwater recharge, Precipitation, Surface-groundwater relations, Irrigation, Drawdown, Water yield, Water quality, Lithologic logs, Hydrologic models, Mathematical models, Forecasting, *Minnesota, Benton County, Sherburne County, Sterns County, Wright County.

Surficial-sand aquifers in 960 square miles of central Minnesota were studied to determine the occurrence, availability, and suitability of the surficial aquifer as a source of water. The aquifer, which is being increasingly developed for irrigation, is predominantly medium to coarse sand with lesser amounts of gravel. Saturated-sand aquifers in the Maine Prairie area locally exceed 100 feet in thickness, and transmissivity exceeds 40,000 feet squared per day. Similar valley-fill deposits in Sherburne County exceed 80 feet in thickness, transmissivity exceeds 30,000 feet squared per day, and expected well yields are from 2,000 to 3,000 gallons per minute. Water is of the calcium bicarbonate type and suitable for most uses. Relatively high nitrate and chloride concentrations occur in a heavily irrigated area in Sherburne County. Surficial aquifers in Sherburne County and the Maine Prairie area of Stearns county were simulated by two-dimensional digital ground-water flow models. Both modeled areas will support additional withdrawals, but caution must be exercised because lowering ground-water levels will also lower the lake levels and reduce streamflow. In some areas, aquifer dewatering will reduce individual well yields. (USGS)
W82-02838

POTENTIOMETRIC SURFACE MAPS OF THE SPARTA SAND: NORTHERN LOUISIANA AND SOUTHERN ARKANSAS, 1900, 1965, 1975, AND 1980,
Geological Survey, Alexandria, LA. Water Resources Div.
G. N. Ryals.
Geological Survey Open-File Report 80-1180, August, 1980. 1 Sheet.

Descriptors: *Maps, *Potentiometric level, *Groundwater, *Aquifers, Contours, Wells, Water level, Pumping, *Louisiana, *Arkansas, Sparta Sand.

The potentiometric surface of the Sparta Sand in northern Louisiana is shown by contours on four maps. Maps for 1900, 1965, and spring 1975 are generalized, small-scale maps from previously published reports. The spring 1980 map (1:500,000) is based on measurements in 144 wells and includes the southern tier of counties in southern Arkansas. The map shows regional effects of pumping from the Sparta Sand and effects of local pumping centers at Magnolia and El Dorado, Ark., and at Minden, Ruston, Jonesboro-Hodge, Winnfield, Bastrop, and in the Monroe area of Louisiana. (USGS)
W82-02839

WATER-LEVEL RECORDS FOR THE BIG SIOUX AQUIFER, MINNEHAHA COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
W. L. Bradford.
Geological Survey Open-File Report 81-222, January, 1981. 50 p, 2 Fig, 1 Tab.

Descriptors: *Water level, *Wells, *Aquifers, Data collections, Hydrologic data, *South Dakota, Minnehaha County, *Big Sioux aquifer.

This report contains a tabulation of water levels in wells tapping the Big Sioux aquifer in Minnehaha County, S. Dak. Included is a compilation of all water levels in 43 wells measured by the U.S. Geological Survey and State agencies during the period 1957-80. The data are presented in tabular and graphic form. (USGS)
W82-02844

RADIOTRACER EVALUATION OF GROUND-WATER DISPERSION IN A MULTI-LAYERED AQUIFER,
Southern Universities Nuclear Inst., Faure (South Africa). Atomic Energy Board Isotope Unit.
B. R. Meyer, C. A. R. Bain, A. S. M. De Jesus, and D. Stephenson.
Journal of Hydrology, Vol 50, No 1-3, p 259-271, March, 1981. 7 Fig, 1 Tab, 4 Ref.

Descriptors: *Tracers, *Saline water intrusion, Groundwater movement, Iodine radioisotopes, Aquifers, Model studies, Nuclear powerplants, Cape Town area, *South Africa.

In order to assess the possibility of seawater permeating inland to the foundations of the Koeberg Nuclear Power Station near Cape Town, South Africa, the groundwater flow conditions were investigated. The dispersion coefficient of the sandy aquifer had to be determined in order to model the effect of dispersion across the seawater/fresh groundwater interface. Iodine-131 was used as a tracer to obtain the dispersion coefficient and the velocity of fresh groundwater. A mathematical model was developed to describe the groundwater flow and intermixing in several layers. The largest effect on dispersion was due to the different flow speeds of water in the different layers. (Cassar-FRC)
W82-02870

RADIOCARBON DATING OF GROUNDWATER OF THE AQUIFER CONFINED IN THE LOWER TRIASSIC SANDSTONES OF THE LORRAINE REGION, FRANCE,
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
B. Blavoux, and P. Olive.
Journal of Hydrology, Vol 54, No 1-3, p 167-183, December, 1981. 10 Fig, 11 Ref.

Descriptors: *Groundwater dating, *Aquifer characteristics, *Radioactive dating, Groundwater, Radiochemical analysis, Sandstones, Isotope studies, *Lorraine, *France.

An isotopic study was carried out on groundwater trapped below a confining bed to determine the tritium, radiocarbon, 13-C, 18-O, and deuterium contents of the aquifer confined in the Lower Triassic sandstones of the Lorraine Region of France. Using 40 boreholes, samples were collected and the temperature, pH, alkalinity, and total dissolved carbon were determined. In the laboratory, the major elements were estimated: 3-H, 18-O, 2-H, 13-C, and 14-C. A significant relationship was determined between total dissolved carbon and 13-C, which indicated a gradual enrichment of the total dissolved carbon with 13-C resulting from the escape of dissolved CO2. The stable isotope study indicated two water families. The radiometric rates were lower than rates calculated by means of current hydraulic parameters. This makes the hypothesis of a permanent flow regime questionable. (Small-FRC)
W82-02877

A METHOD OF PERFORMING RESPONSE TESTS ON HIGHLY PERMEABLE AQUIFERS,
Department of the Environment, Edmonton. Div. of Earth Sciences.
D. W. Prosser.
Ground Water, Vol 19, No 6, p 588-592, November/December, 1981. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Hydraulic conductivity, *Aquifer testing, Permeability, Groundwater movement, Pressure head.

Electronic pressure transducers and pneumatically induced head differences were used to accurately measure response time in small diameter (2 inch) standpipes under conditions of very high hydraulic conductivity. Values of hydraulic conductivity obtained in nine tests using three types of slugs were as follows: solid plastic slug, 0.0053 cm per sec; water slug, 0.0076-0.012 cm per sec; and pneumatic, 0.018-0.021 cm per sec. Response times in seconds ranged from 26 with the solid slug to 6.5 in the pneumatic method. The procedure relies on increasing air pressure in the standpipe to displace the water column. Then the air pressure is suddenly released and the head difference measured. Data can be recorded digitally or by analog chart recorder with fast paper speed. Time lags down to 1.6 sec, corresponding to a hydraulic conductivity of 0.1 cm per sec, have been measured successfully. The inertia of the air and water columns and well losses at the screen put a practical upper limit on the system. (Cassar-FRC)
W82-02916

DETERMINATION OF AQUIFER PARAMETERS FROM LARGE-DIAMETER DUG WELL PUMPING TESTS,
Institute of Geological Science, Wallingford (England).
R. Herbert, and R Kitching.
Ground Water, Vol 19, No 6, p 593-599, November/December, 1981. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Transmissivity, *Pumping tests, *Aquifer testing, Hydraulic conductivity, Dug wells, Shallow wells, Wells, Partially penetrating wells, Anisotropy, Model studies, Groundwater movement, Drawdown, Water level, *Aquifer characteristics.

Transmissivities of aquifers were determined in dug wells by recovery to 50% and 90% of the maximum drawdown levels. These two methods were developed using a digital model to simulate flow to a partially penetrating large-diameter well. In the 50% test a well is pumped for an hour and the time to recover to the 50% level is noted. Transmissivity is predicted using a given equation. Transmisssivity may be in error, high or low, by a factor of 2. Longer pumping times produce more accurate results. In the 90% test the well is pumped for a period of time, and a shape factor is obtained from a graph, knowing the aquifer and well dimensions. The slope of the recovery at 90% recovery level is read from a plot of log drawdown against time. These figures are used in an equation to calculate hydraulic conductivity. Variations are given to account for vertical anisotropy. Neither of these methods can be used if there are nearby hydrogeological boundaries to flow. The recovery test methods are illustrated in two examples. In the second case transmissivity is deduced from both the 50% and the 90% methods (8.4 sq m per day) and the anisotropy determined, 2.8. (Cassar-FRC)
W82-02917

INFLUENCE OF HEAT DISPERSION ON STEADY CONVECTION IN ANISOTROPIC POROUS MEDIA,
Oslo Univ. (Norway). Dept. of Mechanics.
P. A. Tyvand.
Journal of Hydrology, Vol 52, No 1/2, p 13-23, June, 1981. 13 Ref.

Descriptors: *Convection, *Conduction, *Heat transfer, *Thermal conductivity, *Porous media, Capillary water, Permeability, Anisotrophy, Boundaries, Boundary conditions, Flow, Buoyancy, Mathematical studies.

A theoretical investigation of heat dispersion on steady buoyancy-driven convection is described. Buoyancy-driven convection in fluid-saturated porous layers has important applications in insulation techniques and flows in soils, snow layers, and oil reservoirs. This type of flow is primarily caused by vertical density gradients. In the investigation, hydrodynamic dispersion was taken into account at small Peclet numbers. An amplitude expansion was applied to solve the nonlinear problem, and the solution to the second order in the amplitude expansion and in the ratio of grain diameter to layer depth was found. Results of the investigation indicate that uniform basic flow does not influence the Nusselt number to the second order. The combination of anisotropy and dispersion effects may have profound influence on the heat transfer through a porous layer. This influence is believed to be stronger than the individual effects, due to the nonlinear character of the phenomena. (Titus-FRC)
W82-02924

URANIUM ISOTOPES AND 226RA CONTENT IN THE DEEP GROUNDWATERS OF THE TRI-STATE REGION, U.S.A.,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 5A.
W82-02939

A GEOCHEMICAL METHOD OF DETERMINING DISPERSIVITY IN REGIONAL GROUNDWATER SYSTEMS,
Texas Tech Univ., Lubbock. Dept. of Geoscience.
W. W. Wood.
Journal of Hydrology, Vol 54, No 1-3, p 209-224, December, 1981. 7 Fig, 28 Ref.

Descriptors: *Aquifer characteristics, *Geochemistry, *Groundwater movement, Aquifers, Groundwater reservoirs, Flow, Solutes, Dispersants, Dispersion.

Some easily obtained chemical observations of natural aquifer systems are used to determine numerical values for dispersivity that are regionally valid. The aquifer system is viewed as a large imaginary column, and analysis of hydrodynamic dispersion is made by observing the relative positions of solute contours in space. Curves relating concentration contour and pore volume of fluids are compared to theoretically developed curves. When a conservative solute is used, a true value of dispersivity is yielded, but the use of reacting solutes limits the separation of mechanical mixing from that caused by inhomogeneity of reaction sites. (Small-FRC)
W82-02941

PREPARATION OF FRIABLE AQUIFEROUS SPECIMENS,
Humphreys (Howard) and Partners, Reading (England).
P. F. Worthington.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY2, p 333-337, February, 1980. 2 Fig, 7 Ref.

Descriptors: *Sample preparation, *Sediments, Cores, Soil water, Sample preservation, *Aquifer characteristics, Sedimentary rocks, Sedimentary petrology, Petrology, Petrography, *Groundwater availability.

Laboratory examination of granular aquifer specimens plays an important role in groundwater resource evaluation. Previous studies had not yielded a suitable method for examining the effective porosity, specific yield, and intergranular permeability of loosely consolidated sedimentary strata without destruction of the specimen. As part of regional groundwater resource evaluation program, a procedure was developed for preparing friable limestone and sandstone specimens from the Kalahari Basin. Cubic specimens with a linear dimension up to 37 mm were cut with a diamond-bladed saw, minimizing the application of water. Before saturation studies were attempted, the specimens were cast in a retaining medium, making sure to avoid contaminating the opposite pair of faces which were to remain exposed. The optimum mixture was found to represent a 10:4:1 ratio of epoxy resin, kaolin filler and hardener. Specimens were mounted in cylindrical perspex rins in two phases. Mounted specimens could be readily fixed into permeameter cells for measurement of permeability and electrical resistivity. Except for the invasion zone (from about 0.5 mm in less permeable samples to about 1 mm in the more permeable samples) the specimen is preserved in the same state as in the original core sample. No loss of specimens took place by disintegration during saturation, flushing and drying or due to uncontrolled contamination by the casting mixture. If necessary, the invasion zone can be measured following completion of all petrophysical measurements by slicing through the specimen perpendicular to the cell axis. The optimum casting mixture may vary for different rock formations. (Baker-FRC)
W82-02955

2G. Water In Soils

COUPLED HEAT AND WATER FLOWS AROUND BURIED CABLES,
Geotechnical Consultants, Inc., San Francisco, CA.
O. N. Abdel-Hadi, and J. K. Mitchell.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT11, p 1461-1487, November, 1981. 20 Fig, 20 Ref.

Descriptors: *Temperature effects, *Soil water, *Electrical equipment, Soil types, Flow, Mathematical studies, Buried cables.

A field test program was designed to provide a basis of comparison between predicted and actual values of moisture and temperature distributions in a study of the transient flow of water in unsaturated soils under thermal gradients. The Philip and DeVries theory was used. A theoretical analysis of moisture movement and important parameters associated with it indicated that the most important parameters were cable temperature and soil type. Gravitational flow, surface evaporation, and isothermal diffusion effect moisture changes in the backfill and are primarily responsible for early changes of moisture content in the trench backfill. There was excellent agreement between measured and predicted temperature contours up to 40 days and good agreement between contours from 40 days to 100 days. (Small-FRC)
W82-02680

ANALYSES OF SOLUTE DISTRIBUTIONS IN DEEPLY WEATHERED SOILS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2K.
W82-02764

AN ANALYSIS OF AREAL INFILTRATION CONSIDERING SPATIAL VARIABILITY,
Commonwealth Scientific and Industrial Research Organisation, Wembley (Australia). Div. of Mathematics and Statistics.
R. A. Maller, and M. L. Sharma.
Journal of Hydrology, Vol 52, No 1/2, p 25-37, June, 1981. 6 Fig, 18 Ref.

Descriptors: *Infiltration, *Groundwater movement, *Fluctuations, *Frequency distribution, *Statistical methods, Seepage, Prediction, Forecasting, Projections, Monte Carlo method, Mathematical models, Model studies, Soil water.

A direct mathematical procedure for studying the effect of spatial variability on areal infiltration flux and average ponding time is presented. This procedure requires less computer time than conventional Monte Carlo simulation and produces results which are free of sampling errors. The distributions of infiltration flux and of time to ponding are derived. These calculations assume bivariate normality of the log of sorptivity and a parameter from the Philips equation. Under the assumption that the parameters were normally distributed rather than lognormal, the expected infiltration was not significantly different, although the standard deviation was increased. (Titus-FRC)
W82-02927

2H. Lakes

SPATIAL AND TEMPORAL OVERLAP IN LAKE PHYTOPLANKTON COMMUNITIES,
Ottawa Univ. (Ontario). Dept. of Botany.
D. Wall, and F. Briand.
Archiv fur Hydrobiologie, Vol 88, No 1, p 45-57, February, 1980. 5 Fig, 2 Tab, 38 Ref.

Descriptors: Nutrients, Species diversity, Eutrophication, Niches, *Ecological effects, Plankton, Water pollution effects, Lakes, Nitrogen, Phosphorus, Algal growth, *Phytoplankton, Aquatic animals, Temporal distribution, Water depth, Species composition, *Heney Lake, *Quebec.

Field studies of niche overlap in enclosed lake phytoplankton communities were conducted in Heney Lake, Quebec, from June to November, 1976. Planktonic communities studied were enclosed in four polyethyelene tubes, each 1 m in diameter and 10 m deep, two of which were freely connected with sediments while the others were sealed at the bottom. In each set of containers, one was enriched with N and P, while the other was not. Phytoplankton densities and species composition were monitored weekly at 0, 3, 6, and 9 m. Overlap in depth was determined quantitatively, while overlap in time was calculated on the basis of presence and absence data within each water column over the 5 month period. Results showed that depth played a major role in separating the dominant species, while partitioning of dominant species' niches by time periods was of little importance. Addition of nutrients generally decreased niche overlap, probably due to increased interspecific competition. Fragilaria crotonensis and Synedra delicatissima expanded their niches in the presence of N and P nutrients and were regarded as superior exploitive competitors. The relationships of eutrophication to reduced diversity and niche overlaps are discussed. (Geiger-FRC)
W82-02610

CHIRONOMIDAE (DIPTERA) OF BALDWIN LAKE, ILLINOIS, A COOLING RESERVOIR,
Southern Illinois Univ. at Carbondale. Dept. of Zoology.
R. B. Parkin, and J. B. Stahl.
Hydrobiologia, Vol 76, No 1/2, p 119-128, 1981. 2 Fig, 8 Tab, 32 Ref.

Descriptors: *Cooling ponds, *Midges, *Temperature effects, Reservoirs, Ponds, *Baldwin Lake, Illinois, Benthos, Powerplants, Lake sediments.

The effects of water temperature and sediment type were studied on the composition, distribution, and abundance of the chironomid fauna of Baldwin Lake, which is a relatively shallow, rectangular lake with a very regular shoreline consisting largely of levees, and a small watershed. The watershed area is only about 0.7 times the lake area, and it is estimated that is supplies only about one-third of the water in the lake. The lake is a closed-cycle cooling reservoir for a power plant. Samples were taken monthly to semi-monthly for one year at four stations, two in the discharge channel and two in the main basin. Twenty-four species were collected. The annual mean population density was less than 100 larvae per square meter in the channel, and 1037/square meter in the main basin. Three species of Tanypodinae formed over 96% of the larval population in the main basin: Tanypus stellatus, Procladius bellus, and COeflotanypus concinnus. Principal species found on multiple plate samplers were Dicrotendipes nervosus, Gluptotendipes lobiferus, and Parachironomus monochromus. Chironomids were virtually eliminated from the channel at temperatures over 35 degrees C. The numbers of generations of T. stellatus were increased from the usual two to four in the main basin at temperatures of 32 degrees C. The sediments in Baldwin Lake were coarse-grained and low in organic carbon. (Baker-FRC)
W82-02620

THE INFLUENCE OF FLATWORM PREDATION ON ZOOPLANKTON INHABITING SMALL PONDS,
Concordia Univ., Montreal (Quebec). Dept. of Biology.
E. J. Maly, S. Schoenholtz, and M. T. Arts.
Hydrobiologia, Vol 76, No 3, p 233-240, 1980. 1 Fig, 6 Tab, 23 Ref.

Descriptors: *Predation, *Shallow water, *Feeding rates, Daphnia, Invertebrates, Ponds, *Zooplankton, Aquatic life, Population dynamics, *Flatworms, Mesostoma, Colorado.

Predation of a predatory flatworm, Mesostoma ehrenbergii, on zooplankton was studied in laboratory beakers, 30 liter tubs, and small shallow ponds at Mexican Cut, western Colorado. The beaker tests in 1977 revealed that M. ehrenbergii consumes Daphnia at a high rate, fairy shrimp (Branchinecta) at a low rate, and does not consume Diaptomus. The tub tests (1978) showed that the predation rate is correlated with surface to volume ratio of the containers. Feeding rates in 8 natural ponds with surface/volume ratios of 1.90 to 6.26 were flat at high surface/volume ratios of because flatworms are satiated. Rates were low at low surface/volume ratios because prey are unavailable to the predator. Flatworms have definite effects on Daphnia population dynamics in some water bodies, especially in shallow ponds. Evidence also suggests that flatworms are attracted to high densities of Daphnia. (Cassar-FRC)
W82-02655

THE RESPONSE OF MACROINVERTEBRATES TO AQUATIC MACROPHYTE DECOMPOSITION,
Virginia Commonwealth Univ., Richmond. Dept. of Biology.
L. A. Smock, and D. L. Stoneburner.
Oikos, Vol 35, No 3, p 397-403, November, 1980. 3 Fig, 2 Tab, 38 Ref.

Descriptors: *Littoral zone, *Macrophytes, *Macroinvertebrates, Brown water, *Barrier islands, Limnology, Aquatic life, Decomposition, Aquatic plants, Ponds, Lakes, Leaves, Lake Whitney, *Georgia, Decomposing organic matter.

The data presented describe the relationship between the degree of decomposition of an aquatic macrophyte and the densities of associated macroinvertebrates in Lake Whitney, Georgia. A significant increase in macroinvertebrate density was noted with the onset and progressive senescence of the leaves, as reflected by decreasing chlorophyll a concentrations. The chironomid Polypedilum nymphaeroum Maschwitz and three species of Naididae exhibited positive responses to presumably increasing levels of food as leaf decomposition progressed. P. nymphaeorum larvae probably switched from feeding on periphyton to utlization of decomposing plant tissue and associated microbial decomposers once the Nelumbo leaves began to decompose. Naididae did not become abundant on the leaves until the onset of initial leaf decomposition. Densities of the carnivorous chironomid Ablabesmyia philosphagnos Beck and Beck were more closely related to the age of the leaves than to prey availability, older leaves having been colonized by several generations of individuals while the younger leaves had been colonized by only one generation of individuals. The findings indicate that all stages in the life of macrophytes must be considered before their full importance to macroinvertebrates can be assessed. Both their abundance in a system and their seasonal cycles of growth and decay can be an important regulator of macroinvertebrate densities in the littoral zones of ponds and lakes. (Baker-FRC)
W82-02664

THE FRESHWATER AND BRACKISH-WATER DIATOMS OF PENIKESE ISLAND, MASSACHUSETTS: 1923-1973,
Southeastern Massachusetts Univ., North Dartmouth.
R. K. Edgar.
Rhodora, Vol 82, No 830, p 305-319, April, 1980. 1 Fig, 23 Ref.

Descriptors: *Ponds, *Marshes, *Plankton, *Diatoms, Species composition, *Aquatic populations, Water quality, Lakes, Seasonal variation, Navidula, Gomphonema, Species diversity, Ecology, Succession, Nitzschia, *Penikese Island, *Massachusetts.

The planktonic, epilithic, epipelic and epiphytic diatom assemblages of the ponds and marsh of Penikese Island were examined along with physicochemical parameters and water quality data. In the ponds, 79 diatom species and subspecific taxa were identified. The marsh contained large populations of Gomphonema paravulum, Navicula calida, N. cuspidata, Nitzschia palea, and Pinnularia viridis in 1973. The northernmost reservoir on the hilltop at the southern end of the island contained mostly planktonic populations of Nitzschia kutzingiana and Navicula cuspidata. Notes on eight selected taxa are included as supplemental descriptions of the species identified. Major qualitative differences were found in the diatom flora of Penikese over a 50 year period. No evaluations have been made to determine to what extent these differences are functions of the seasonally variable nature of the ponds and the successional changes in the environment over the past few decades. (Geiger-FRC)
W82-02696

CHEMISTRY OF A 7.5-M SEDIMENT CORE FROM LAKE VALENCIA, VENEZUELA,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
W. M. Lewis, Jr., and F. H. Weibezahn.
Limnology and Oceanography, Vol 26, No 5, p 907-924, September, 1981. 11 Fig, 1 Tab, 55 Ref.

Descriptors: *Sediments, *Geologic history, *Lakes, Salinity, *Chemical composition, Eutrophication, *Lake Valencia, Venezuela, Chemistry of precipitation.

The chemistry of the upper 7.5 m of sediment taken from the middle of Lake Valencia in 37 m of water was studied. This midlake core provides a record of changes in the lake and its watershed over about 13,000 years. The lake began as a dry or seasonal lakebed, accumulating fine clastic materials low in organic matter and essentially devoid of aquatic microfossils. The lake then became permanent, saline, and rather deep. The trend toward freshness and high lake level peaked about 8000 BP, but this moisture peak was brief. There was a return to more saline conditions about 7400 BP, accompanied by high Mg:Ca ratios. The lake is now subject to major artificial eutrophication. Lakes of the lowland tropics have shown radical changes in chemistry, nutrient budgets, and water level over the relatively recent past. The general sequence of events in the lake is similar to sequences documented in the African lowland tropics over the last 13,000 years. (Small-FRC)
W82-02745

COMPARISON OF THE CHEMICAL COMPOSITION OF THE WATERS OF LAKE PIASECZNO (LECZYNSKO-WLODAWSKIE LAKE DISTRICT) AND OF THE SHALLOW GROUND WATERS IN ITS CATCHMENT AREA,
Akademia Rolnicza, Lubin (Poland), Inst. Gleboznawstwa i Chemii Rolnej.
M. Misztal.
Acta Hydrobiologica, Vol 22, No 3, p 239-247, 1980. 3 Fig, 7 Ref.

Descriptors: *Water analysis, *Chemical composition, *Poland, Chemical analysis, *Lakes, *Wells, Potassium, Phosphorus, Sodium, Calcium, Manganese, Seasonal variations, Acidity, Shallow wells.

Water samples were collected from farm wells in the territory of the catchment area of Lake Piaseczno. Lake water samples were also taken. The Lake is small, with part of the catchment territory being covered with forests and others consisting of arable land and a small peat bog. Water level in the wells was highest in the spring of 1975 and subsequently decreased systematically until November. In December and January of the next year a rise in water level was noted, reaching a maximum in April. Lake waters demonstrated rather significant changes in pH, with boundary pH values for waters of the lake taken from the sector adjoining arable land from 6.1 to 8.4 and in the sector bound by forests from 5.8 to 8.6. Variations in the pH of ground waters ranged from 5.8 to 7.8. Phosphorus concentrations also varied considerably, while potassium concentrations remained about the same. Variations in calcium, sodium, and manganese were more similar to the slight changes noted in potassium concentrations. The water from the lake was about 10 times poorer in phosphorus, sodium, calcium, and manganese, and about 5 times poorer in potassium in comparison with the water from the farm wells. The inflow of sodium into the ground water was particularly dependent on the magnitude of rainfall. (Baker-FRC)
W82-02752

SOME HYDROBIOLOGICAL CHARACTERISTICS IN AMVRAKIA LAKE, WESTERN GREECE,
Institute of Oceanographic and Fisheries Researches, Athens (Greece).
T. S. Koussouris, and J. D. Photis.
Acta Hydrobiologica, Vol 22, No 3, p 337-344, 1980. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Lakes, *Hydrobiology, Tectonics, Thermoclines, *Greece, Aquatic fauna, Plankton, Zooplankton, Phytoplankton, *Amvrakia Lake.

Amvrakia lake is situated in Western Greece and is of tectonic origin, with a northwestern direction. Its water level depends mainly on surface drains, karstic springs, possible underground inlets and invisible discharges. High to mean values of dissolved oxygen were recorded in the lake in the homogenous water column in February, while by June its low values at deep waters were accompanied by hydrogen sulfide. In June fairly stable thermal stratification occurred. The thermocline was between 11 and 13 meters deep. The pH was generally mean to high in the southern basin and high in the northern basin. A vertical variation in pH was noted, probably caused by consumption of carbon dioxide in the epilimnion and release in the hypolimnion. Aquatic macrovegetation was lacking along the shoreline of the lake. The main components of plankton were Cyclotella ocellata (Ehr.) Kutz. and Closterium, Scenedesmus, Prediastrum, Ankistrodesmus species in February, while in June the dominant species comprise some Pennales diatoms and the Chlorophyceae Elakatothrix gelatinosa Wille, Staurastrum leptocladum Wille and Closterium spp. Among the zooplankters the appearance of tintinnopsis lacustris (Entz) Kahl and of Brachionus angularis Gosse, Br. calyciflorus Pall, Polyarthra vulgaris Carl., Filinia longiesta (Ehr.) and Keratella quadrata (Mull.) were characteristic. (Baker-FRC)
W82-02753

LAKE VATTERN,
S. A. Svensson.
Aqua, No 4, p 9-10, 1981.

Descriptors: *Lakes, *Water pollution control, Phosphorus, *Lake Vattern, *Sweden, Nutrients.

Lake Vattern is Sweden's second largest lake and possesses clear, cold water. The biological and chemical studies made of the lake indicate that it contains few nutrients, while it is also a valuable recreational and raw-water source for the area. Vattern contains at least 28 different species of fish, with the principal species being whitefish and char. The question of safeguarding Vattern was raised at the end of the 1950s, when repeated indications regarding changes in the catch of char, increased vegetation, and other changes indicated pollution patterns were occurring. An investigation then showed that in the inflow of organic substances, particularly phosphorus, must decrease if Vattern was not to become a protein-rich lake with accelerated aging. The measures adopted included the requirement that the majority of local authority sewage treatment works be extended to include biological and chemical purification and that effluent treatment and other internal measures be taken within appropriate industries. More natural conditions are now reappearing in the lake. (Baker-FRC)
W82-02755

STANDING CROP DENSITIES AND DISTRIBUTION OF SPIRULINA AND BENTHIC DIATOMS IN EAST AFRICAN ALKALINE SALINE LAKES,
Bristol Univ. (England). Dept. of Zoology.
C. H. Tuite.
Freshwater Biology, Vol 11, No 4, p 345-360, 1981. 7 Fig, 3 Tab, 38 Ref.

Descriptors: *Saline lakes, *Diatoms, Algae, Benthos, Aquatic life, East Africa, *Africa, Spirulina, Lakes, Standing crops.

Information is given about the structure of the primary producer communities in East African alkaline saline lakes and their temporal changes. Measurements were taken of the standing crop densities of phytoplanktonic blue-green algae of the genus spirulina and benthic diatoms. Spirulina abundance was measured as dry mass density, and the validity of the gravimetric estimates was determined by chlorophyll analysis and microscopic counting. Benthic diatom standing crops were assessed by chlorophyll determinations. Spirulina density was extremely variable in time and may appear to fluctuate over more than an order of magnitude. It was not common to see high density blooms of Spirulina as a feature in the lakes. The causes of changes in Spirulina standing crop and the associated alterations in the structure of the primary producer community are discussed. Three qualitative states which may occur are described. Similar standing crops of benthic diatoms were noted in all lakes wherever the water depth was shallow enough to allow light penetration to the sediment surface. (Baker-FRC)
W82-02759

STUDIES ON THE SEASONAL CHANGES OF DISSOLVED ORGANIC CARBON, NITROGEN, PHOSPHORUS AND UREA CONCENTRATIONS IN LAKE BIWA,
Osaka Kyoiku Univ. (Japan). Lab. of Environmental Science.
O. Mitamura, and Y. Saijo.
Archiv fur Hydrobiologie, Vol 91, No 1, p 1-14, March, 1981. 3 Fig, 4 Tab, 35 Ref.

Descriptors: *Seasonal variation, *Dissolved solids, *Lakes, *Japan, Lake Biwa, *Organic carbon, Phosphorus, Nitrogen, Carbon, Urea, Phytoplankton, Algae.

Although there have been many studies of the distribution of dissolved organic matter in the sea, few studies have investigated the concentrations of dissolved nitrogen, carbon, and phosphorus in freshwater. The seasonal variations in dissolved organic carbon (COD), dissolved organic nitrogen (DON), dissolved organic phosphorus (DOP), and urea concentrations in Lake Biwa were investigated in relationship to changes in the thermal stratification of the lake and in the blooming of phytoplankton. Lake Biwa, the largest lake in Japan, has an area of 674.8 square kilometers and a maximum depth of 104 meters. Observations were made at one station in the northern basin (72 meters depth) and one in the southern basin (4 meters depth). The mean DOC values in the upper level layer in the northern basin were consistently higher than those in the lower layer during the thermal stratification period, giving values of 143 and 119 micrograms carbon per liter, respectively. DON, DOP, and urea concentrations showed similar tendencies, giving values of 6.2 and 5.2 micrograms nitrogen per liter, 0.20 and 0.16 micrograms phosphorus per liter, and 0.40 and 0.29 micromoles urea per liter, respectively. The lowest mean values of DON, DOP, and urea in the upper layer were found in November, when the green alga, Staurastrum sp., was blooming profusely. High correlation coefficients were obtained among DOC, DON, and DOP in the lower layer. (Carroll-FRC)
W82-02768

EFFECTS OF SHORT-TERM CHANGES IN RAIN WATER SUPPLY ON THE IONIC COMPOSITION OF ACID MOORLAND POOLS IN THE CAMPINE OF ANTWERP (BELGIUM),
J. H. D. Vangenechten, F. Bosmans, and H. Deckers.
Hydrobiologia, Vol 76, No 1/2, p 149-159, 1981. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Chemical composition, *Pools, Seasonal variation, Temperature effects, *Belgium, Acidity, Rainfall, *Bogs, Snowmelt, Evaporation, Water level, Rainwater, Water supply.

Physico-chemical characteristics of acid bog lakes were investigated in direct relation to some changes in water supply. During a 3.5 yr survey of 27 bog lakes, very marked changes in water levels were noted as a consequence of climatic conditions. Except for the summer and autumn of 1976, which were very dry and hot, the changes in ionic concentrations from September 1975 through March 1979 were very slight. Most ions exhibited a peak concentration during a few months of 1976. The pH in all pools remained fairly constant. In pools which dried out completely, strongly increased calcium, magnesium and sulfate concentrations were noted during the first months of refilling in autumn. In contrast, pH, potassium and chloride were not changed as compared to values in spring. Only a small increase in sodium was noted. A very high correlation was noted between sulfate and the sum of calcium, magnesium, and sodium, during this time. In pools in which the bottom layer

remained wet during the hot summer, the ionic concentration ratios remained fairly constant. The pH did not change, remaining very acid. It was concluded that during periods of evaporation and subsequent refilling, marked changes in the ionic concentrations and composition can occur. These changes can induce severe stress situations for the aquatic organisms. (Baker-FRC)
W82-02775

ALLOCHTHONOUS PLANT LITTER AS A SOURCE OF ORGANIC MATERIAL IN AN OLIGOTROPHIC LAKE (LLYN FRONGOCH),
University Coll. of Wales, Aberystwyth. Dept. of Zoology.
R. D. G. Hanlon.
Hydrobiologia, Vol 80, No 3, p 257-261, 1981. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Organic matter, *Oligotrophic lakes, *Litter, Lakes, *Llyn Frongoch, Forest litter, Nutrients, Energy sources, Productivity, *Wales, Carbon cycle.

Planting trees along the shoreline of small oligotrophic lakes with low surface area: shoreline length ratios could provide organic carbon for benthic invertebrates and microorganisms. The contribution of airborne plant litter to Llyn Frongoch, Wales, was estimated to be 100 kg per year (45 kg C per year), equivalent to 5% of the phytoplankton productivity. This lake has an area of 7.2 ha and 23% of the 1450 meters of shoreline is tree-covered. Most of the airborne plant litter was deposited within 10 meters of shore, and the amount of litterfall declined exponentially with distance from the shore. (Cassar-FRC)
W82-02778

THE GAMMARIDAE AND CORIXIDAE OF AN INLAND SALINE LAKE FROM 1975 TO 1978,
Crewe and Alsager Coll., Alsager (England).
A. A. Savage.
Hydrobiologia, Vol 76, No 1/2, p 33-44, 1981. 4 Fig, 5 Tab, 17 Ref.

Descriptors: *Saline lakes, *Benthos, Temperature effects, Seasonal variation, Population dynamics, Vegetation, *Aquatic vegetation, Chemical composition, Salinity, Aquatic organisms.

Changes in the populations of Gammaridae and Corixidae were investigated together with data on sub-aquatic vegetation, chemical conditions and temperature in an inland saline pond, Watch Lane Flash. Comparisons were made with two immediately adjacent pools, Ilse Pool and Red Lane Flash. In 1975, when subaquatic vegetation was virtually absent and summer temperatures and salinities were high, the population consisted almost entirely of Gammarus duebeni and Sigara lateralis. G. tigrinus was first recorded in September. During 1976, when summer temperatures and salinities were again high, G. tigrinus increased rapidly, G. duebeni and fifth instar nymphs of S. lateralis decreased to zero, but adults of the latter species were present. When summer temperatures and salinities were lower during 1977, G. tigrinus increased further; G. duebeni and nymphs and adults of S. lateralis were virtually absent. Subaquatic vegetation redeveloped and nymphs and adults of Sigara concinna were found. The initial success of G. tigrinus coincided with high summer temperatures and salinities. Evidence is presented which suggests that high summer temperatures rather than high salinities especially favor G. tigrinus. It is felt that the exclusion of G. duebeni and S. lateralis was caused by both predation and competition for similar food resources. (Baker-FRC)
W82-02779

ABSORPTION BY CHLORELLA VULGARIS BEIJER. OF PHOSPHORUS COMPOUNDS RELEASED BY THE SUBMERGED MACROPHYTE POTAMOGETON PECTINATUS L.,
Rand Afrikaans Univ., Johannesburg (South Africa). Research Group for Freshwater Biology.
I. S. Van Aswegen, J. H. Swanepoel, and H. J. Schoonbee.
Water SA, Vol 7, No 2, p 76-78, April, 1981. 2 Tab, 9 Ref.

Descriptors: *Phosphorus, *Algal growth, Lakes, Eutrophication, Nutrients, Macrophytes, Algae, Absorption, Accumulation, Chlorella, Phytoplankton, Natural waters, *Phosphorous absorption.

Chlorella vulgaris was used as a test organism to determine the ability of this alga to absorb phosphorus released by both the foliage and the roots of Potamogeton pectinatus. The plants were grown in an aquarium from tubers collected from a lab stream ecosystem. Phosphorus compounds released by both the foliage and roots of the submerged macrophyte were absorbed by Chlorella vulgaris under both light and dark conditions. Chlorella absorbed more phosphorus compounds when incubated in the light than in the dark, which may be related to photosynthetic activity. The P-32 activity of the Chlorella incubation medium derived from the roots of Potamogeton was substantially higher than that derived from the foliage of this hydrophtye. During both light and dark incubation, Chlorella absorbed more or less 40 times more root phosphorus than foliar phosphorus. This may be partly attributed to the higher phosphorus concentration of the incubation medium derived from the root compartment of the culture vessel. It is suggested that in freshwater lakes phosphorus compounds released by the foliage of submerged macrophytes may well be an important source of phosphorus to phytoplankton and epiphytes associated with submerged macrophytes. The ready accessibility of phosphorus released by the roots of aquatic macrophytes for algal absorption may account for the frequent development of dense mats of benthic algae observed on the substrate in water bodies such as Germiston Lake in the Witwatersrand area. (Baker-FRC)
W82-02780

PRODUCTION OF GAMMARUS LACUSTRIS (AMPHIPODA, GAMMARIDAE) IN LAKE SEVAN,
Akademiya Nauk Armyanskoi SSR, Hydrobiological Station.
S. G. Nikolayev.
Hydrobiological Journal, Vol 16, No 4, p 40-44, 1980. 2 Tab, 19 Ref.

Descriptors: *Lakes, *Gammarus, *Amphipods, *Population dynamics, Aquatic life, *Lake Sevan, USSR, Productivity, Water level fluctuations.

The production of Gammarus lacustris in one of the foraging areas of Lake Sevan was determined. The Lake had undergone a reduction in level, which had led to alterations of the thermal regime and appreciably affected hydrobiological processes in the lake. Records of the zoobenthos of one of the main foraging areas of the lake, Noraduzskiy Bay, made between April 1975 and November 1976 were used for calculations. Samples were taken in the moss beds at depths between 6 and 12 meters. Eighty such samples were processed. A single sample usually contained the collections of 2 bottom grabs. Changes in the lake have occurred over the years since 1938. As a result of these changes, especially of the more intensive heating of the water in comparison with the period before level reduction and the intensified pressure of predators as a result of the enlargement of the fish stock in the lake, changes were also expected in the production features of the gammarid population. The annual production/biomass (P/B) coefficient recalculated from the 1938 data proved fairly close to the annual P/B coefficient for 15, although it was lower. The data for comparison are the results of year-long observations seperated by an appreciable time interval. They cannot be used to characterize two long periods in the history of the lake in view of annual fluctuations in the production indices of amphipods. It is expected, however, that the mean annual values of the P/B coefficient for the 1938-1939 and 1975-1976 periods would be of similar magnitude. It was concluded that the rate of production of the gammarid population in this area of the lake has apparently remained at the 1938-1939 level. (Baker-FRC)
W82-02781

ON THE SAMPLING SIZE OF ZOOBENTHOS ALONG A LAKE SHORE (IN JANPANESE),
Shibukawa Senior Girls High School, Gunma (Japan).
H. Kurita, and H. Minemura.
Japanese Journal of Limnology, Vol 42, No 1, p 46-51, 1981. 3 Fig, 3 Tab.

Descriptors: *Lakes, *Benthos, Zooplankton, *Lake Haruna, Measuring instruments, Bottom sediments, Sampling, *Japan, Bottom sampling.

A new type of bottom sampler with a circular quadrat was used to analyze the number of replicate samples required to estimate the species number, density and biomass of zoobenthos along a shallow shore of Lake Haruna, Gunma Prefecture, in August of 1978. A very large number of replicate samples were required to estimate the total number of taxa and individuals, and the total biomass, in the shallow part of the stony zone, where the samples presented a poor fauna and a large variation. In the deeper stony and aquatic plant zone, with an abundant fauna and a smaller variation of samples, about six replicate samples were required to estimate the number and the biomass at the permissible 30% error level and the 95% level of confidence of the mean. A large number of samples are required to identify species showing a low density and an aggregated distribution. (Baker-FRC)
W82-02796

THREE COASTAL LAKES ON KAMIKOSHIKI ISLAND, KAGOSHIMA PREFECTURE,
Nagasaki Univ. (Japan). Faculty of Fisheries.
M. Matsuyama.
Japanese Journal of Limnology, Vol 42, No 1, p 52-57, 1981. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Lakes, *Stratification, Bottom sediments, Chlorine, Coastal waters, *Japan, *Lake Kaiike, Saline water intrusion, Limnology.

An outline of Lake Kaiike and two adjacent lakes, Namakoike and Kazakiike, is offered, and the stratified condition of Lake Kaiike is considered in relation to these other two lakes. All these lakes are cut off from the sea by a long gravel bar about 3.5 km long, 50 meters wide, and 2-5 meters high. At present, the leeward half of the gravel bar which faces the lake is overgrown with scrub about 4 meters high except in areas of erosion. The lakes receive little inflow of fresh water except for rainwater runoff, and they have no surface outlet across the bar. Intrusion of seawater into Lake Kaiike is slight compared with Lake Namakoike. The littoral zone is dominated by submerged plants, and the sublittoral area is vegetated by plants such as Cyperaceae and Gramineae. On the southeast side of the lake, a swamp called Suguchiike is present. In Lake Namakoike both temperature and dissolved oxygen decreased with depth, but chlorinity exhibited only a slight increase with depth. Hydrogen sulfide was restricted to the bottom water, and a significant exchange of water with the sea through the gravel bar was important in preventing the lake from becoming stratified like Lake Kaiike. Chlorinity was low in Lake Kazakiike and there is no indication of stratification. It is important to clarify whether a stratified stage occurs only in Lake Kaiike or is ubiquitous in basins produced by deposition of a gravel bar across the indentations of sea coast. (Baker-FRC)
W82-02798

FUNCTIONAL RELATIONSHIPS BETWEEN NUTRIENT DYNAMICS, OXIDATION-REDUCTION CAPACITY, AND EUTROPHICATION IN A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Dept. of Biological Sciences.
R. W. Kortmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168550, Price codes: A08 in paper copy, A01 in microfiche. PhD Dissertation, June, 1981. 140 p, 17 Fig, 17 Tab, 69 Ref. OWRT-A-071-CONN(6), 14-31-0007-6007.

Descriptors: Nutrient behavior, Dissolved nitrogen, Phosphorus budgets, Benthic fluxes, *Lakes, *Limnology, *Nutrients, Phosphorus, Benthos, Hypolimnion, Epilimnion, Inflow, Oxidation-reduction potential, *Eutrophication.

The net nutrient behavior (Net System Flux) of a softwater lake was determined on a weekly schedule using steady-state compartment modeling. The watershed hydrology (upon which budget accuracy depends) was defined using storm event sampling, unit-hydrograph simulation, groundwater simulation and in situ seepometers. Highly significant correlation was found between flowrates predicted by unit hydrograph simulation and observed flow-rates. Phosphorus concentration and hydrograph flowstage exhibited a significant relationship (prepeak postpeak baseflow). Chemical and hydrological data were combined using 'flow-interval' and 'typical concentration' techniques, resulting in dissolved nitrogen and phosphorus budgets of high resolution. Hypolimnetic-epilimnetic and benthic fluxes of nutrients and reduced chemical compounds (products of anaerobic respiration) were determined by in situ incubation and application of eddy diffusion coefficient estimates. Transport of ferrous iron, methane (dissolved gas) and total sulfide across the sediment-water interface was about 50, 700, and 10, x10exp-7 moles per square centimeter per year, respectively. Transport of ferrous iron, total phosphorus, ammonia, carbon dioxide, oxygen and silica across the 2.5 meter plane was about +0.0237, +0.016, +0.432, +0.0015, -3.71, and +0.368 micromoles per square meter per day, respectively, while the hypolimnion was anoxic. Benthic flux of total phosphorus, determined by in situ incubation was about 30.6 (+ or - 15%) milligrams per square meter per day, which compared well with literature values. Nutrient cycling between sediments and epilimnetic water represents a significant budget contribution.
W82-02810

EFFECTS OF WHOLE LAKE MIXING ON WATER QUALITY AND PHYTOPLANKTON,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
For primary bibliographic entry see Field 5G.
W82-02823

HYDROLOGIC DESCRIPTION OF LAKE HANCOCK, POLK COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
K. M. Hammett, L. J. Snell, and B. F. Joyner.
Geological Survey Open-File Report 81-131 (WRI), 1981. 1 Sheet, 13 Fig, 2 Tab, 21 Ref.

Descriptors: *Lakes, *Limnology, *Lake morphometry, Hydrologic budget, Lake stages, Eutrophication, Surface-groundwater relations, Water quality, Chemical analysis, Water analysis, Data collections, *Florida, Polk County, *Lake Hancock.

Available data were evaluated to document hydrologic conditions in the Lake Hancock basin. Bathymetric data indicate that Lake Hancock is very shallow, having a maximum depth of about 3 feet. The lake bottom is covered by a layer of organic material that may be more than 5 feet thick near the center of the lake. Lake Hancock's stage fluctuates within 0.5 foot of average stage about 40 percent of the time. Lake outflow is through an operable control. There are many days with no outflow in some years. A water-budget analysis of the lake indicates that substantial lake stage declines in 1968 and 1975 followed successive years of deficient precipitation and were primarily the result of a net loss of water from the lake to the ground-water system. During a period in 1971-72 when lake stage remained relatively stable, the ground-water system contributed a significant volume of water to the lake. Water-quality data indicate that Lake Hancock is in a eutrophic state. The eutrophication process appears to have been accelerated through the addition of nutrients from inflow of wastewater effluent from secondary treatment plants. (USGS)
W82-02843

SOME ECOLOGICAL ASPECTS OF LAKE QARUN, FAYOUM, EGYPT. PART I. PHYSICO-CHEMICAL ENVIRONMENT,
Institute of Oceanography and Fisheries, Cairo (Egypt). Inland Waters and Fish Culture Div.
M. M. Ishak, and S. A. Abdel-Malek.
Hydrobiologia, Vol 74, No 2, p 173-178, September, 1980. 4 Fig, 4 Tab, 21 Ref.

Descriptors: *Salinity, *Nutrients, *Water quality, Lakes, *Lake Qarun, *Egypt, Saline lakes, Drainage canals, Fertilizers, Nitrogen compounds, Nitrates, Nitrites, Phosphates, Water pollution sources, Physicochemical properties.

Physicochemical changes in Lake Qarun, Egypt, are described. The 235 sq km lake is 40 km long and 9.25 km at the widest point. Mean depth is 4.2 meters and the lake level is 44 meters below sea level. The lake receives 390 million cu meters of water annually from two drainage canals. An equal amount evaporates, leaving 430,000 tons of salts from two drainage canals. An equal amount evaporates, leaving 430,000 tons of salts each year and thus increasing salinity with time. Construction of the Aswan Dam in 1965 has decreased suspended matter in Nile water, necessitating use of artificial fertilizers, which also increases salinity. Salinity has increased from 10.65-11.26 o/oo in 1906 to 30.6 o/oo in 1955 and 30.9-34.5 o/oo in 1974-76. Present values are 26-29 o/oo in winter and 33-34 o/oo in summer. Other water quality parameters are: transparency, 60 cm near the drainage canal to 200-300 cm in the western part; nitrates, 36.83-55.92 mg-atom per liter nitrate-N; nitrates, 0-0.125 mg-atom per liter nitrate-N; and phosphates, 0-0.7 mg-atom per liter phosphate-P. (Cassar-FRC)
W82-02859

THE PRODUCTION ECOLOGY OF BENTHIC PLANTS IN SOME ANTARCTIC LAKES. I. IN SITU PRODUCTION STUDIES,
Natural Environment Research Council, Cambridge (England). British Antarctic Survey.
J. Priddle.
Journal of Ecology, Vol 68, No 1, p 141-153, March, 1980. 4 Fig, 2 Tab, 38 Ref.

Descriptors: *Antarctic, *Lakes, *Benthic flora, Aquatic plants, Productivity, Algae, Polar regions, Phytoplankton, Ice cover, Iced lakes, Seasonal, Aquatic productivity, Limnology, Oxygen, Respiration, Mosses, Signy Island, Light intensity.

Three oligotrophic lakes on Signy Island, Antarctica, were studied May 1976 to March 1977 to characterize their productivity. Phytoplankton was sparse; benthic plants predominated. This community had adapted to the low light intensity under the ice cover, so that growth stops only during early winter (June to early August) when plants are below the compensation point. Irradiance at the bottom of the lakes ranged from 1 in midwinter to 2600 kJ per sq meter per day in early summer. Production rates were no higher during the open water period, and no photo-inhibition was observed. Annual production (carbon in g per sq meter) for three benthic communities was: Tolypothrix-Plectonema (Sombre Lake), 9; Phormidium dominated algal felt (Changing Lake), 3.3; and aquatic mosses Calliergon and Drepanocladus (Moss Lake), 4. Maximum productivity rates of the above three communities (measured as oxygen evolution rate per unit ash-free dry weight, micrograms per mg per day) were 10.8, 4.2, and 7.7, respectively. More eutrophic lakes on the same island have a seasonal phytoplankton growth as well as the benthic and mixed vegetation. (Cassar-FRC)
W82-02860

THE PRODUCTION ECOLOGY OF BENTHIC PLANTS IN SOME ANTARCTIC LAKES. II. LABORATORY PHYSIOLOGY STUDIES,
Natural Environment Research Council, Cambridge (England). British Antarctic Survey.
J. Priddle.
Journal of Ecology, Vol 68, No 1, p 155-166, March, 1980. 5 Fig, 1 Tab, 23 Ref.

Descriptors: *Iced lakes, *Photosynthesis, *Algae, *Mosses, *Water temperature, *Antarctic, Polar regions, Lakes, Aquatic plants, Respiration, Light penetration, Light intensity, Irradiation, Plant physiology, Oxygen uptake, Oxygen, Temperature effects.

The photosynthetic physiology of two algal communities and two aquatic mosses from the Antarctic lakes of Signy Island were studied in laboratory tests. Blue-green algae Tolypothrix and Plectonema displayed a light compensation point of 0.17 W/sq m. These algae had a maximum net rate of oxygen production per unit ash-free weight of about 0.6 micrograms/milligram/hour, with a high and variable rate of respiratory oxygen uptake. A predominantly Phormidium community with a compensation point of 0.09 W/sq m had a lower maximum net rate of oxygen production and respiration rate. The mosses Calliergon sarmentosum and Drepanocladus sp. had similar respiration rates (about 0.3 micrograms/milligram hour per unit ash-free dry weight) at normal lake temperatures. Between 1.2 and 30 degrees, respiration rate increased linearly with temperature at different rates for the two mosses. Drepanocladus displayed a compensation point similar to the algal communities studied, while Calliergon had a higher compensation point. When temperature was increased in the experimental range of irradiance, the compensation point also shifted to a higher irradiance, especially in the Calliergon mosses. (Geiger-FRC)
W82-02861

PRODUCTION STRATEGIES IN ANTARCTIC INLAND WATERS: PHYTOPLANKTON ECOPHYSIOLOGY IN A PERMANENTLY ICE-COVERED LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 2C.
W82-02862

IRON AND MANGANESE IN LAKE VECHTEN (THE NETHERLANDS): DYNAMICS AND ROLE IN THE CYCLE OF REDUCING POWER,
Institute of Limnology, Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2K.
W82-02864

CYCLOPS SCUTIFER SARS - ONE AND TWO-YEAR LIFE CYCLES WITH DIAPAUSE IN THE MEROMICTIC LAKE BLANKVATN,
Oslo Univ. (Norway). Inst. of Zoology.
K. Elgmork, and A. Langeland.
Archiv fur Hydrobiologie, Vol 88, No 2, p 178-201, March, 1980. 15 Fig, 45 Ref.

Descriptors: *Cyclops, *Meromictic lakes, *Life cycles, Lakes, *Copepods, Aquatic animals, Crustaceans, Mixolimnion, Chemocline, Plankton, Lake sediments, Seasonal distribution, Monimolimnion, Limnology, Hydrobiology, Aquatic populations, *Lake Blankvatn, *Norway.

A detailed life history study of a freshwater copepod population of Cyclops scutifer Sars was undertaken at the 55 m deep, meromictic lake Blankvatn just north of Oslo, Norway. The copepod life cycle consists of both a one- and a two-year developmental sequence with diapause in the sediment lasting from September to April. Members in the plankton and in diapause in the sediment are restricted to the mixolimnion, with greatest numbers close to the sediment are restricted to the mixolimnion, with greatest numbers close to the surface and to the chemocline for the planktonic phase and near the chemocline for the diapause phase. C. scutifer exhibits three main reproductive periods, one in spring, one in late summer, and one in winter. Part of the diapause population was also found in sediments of the monimolimnion. A long residence near the chemocline was noted for copepods preparing for diapause. No vertical migration was observed. (Geiger-FRC)
W82-02865

THE USE OF DIALYZING SACKS IN ESTIMATION OF PRODUCTION OF BACTERIOPLANKTON AND PHYTOPLANKTON,

Eotvos Lorand Univ., Budapest (Hungary). Dept. of Plant Systematics and Ecology.
For primary bibliographic entry see Field 7B.
W82-02866

POST-GLACIAL SEDIMENTS IN LAKE LINNEVATN, SPITSBERGEN,
Oslo Univ. (Norway). Inst. of Limnology.
A. Boyum, and J. Kjensmo.
Archiv fur Hydrobiologie, Vol 88, No 2, p 232-249, March, 1980. 9 Fig, 2 Tab, 15 Ref.

Descriptors: *Lake sediments, *Sedimentology, *Paleolimnology, Core logging, Glacial sediments, Bottom sedimentation, Sedimentation basins, Limnology, Radioactive dating, Carbon radioisotopes, Carbon, Carbonates, Leaching, *Lake Linnevatn, *Norway.

A sediment core of 560 cm from Lake Linnevatn, Spitsbergen, Norway was studied in efforts to reveal the post-glacial history of the lake basin which once was part of the Isfjorden. Chemical studies on sediment clearly showed the seawater and freshwater periods of the basin. The entire post-glacial history of the lake was characterized by highly inorganic sediments. In sediments of the seawater period, total carbon content was high, and carbonate fractions caused severe errors when radiocarbon dating was used. Examinations of the transition sediments, a sandy layer at 300 cm marking the change from seawater to freshwater, resulted in calculations of 3,300 years as the freshwater period of Lake Linnevatn. Leaching in a freshwater environment caused increases in sediment aluminum levels. Additional changes in the composition of sediments at 300 cm in the core were attributed to a shift in the parent rocks from which the sediments were derived. (Geiger-FRC)
W82-02869

PERIPHYTON IN THE VOLTA LAKE. I. SEASONAL CHANGES ON THE TRUNKS OF FLOODED TREES,
Volta Lake Research and Development Project, Akosombo (Ghana).
E. K. Obeng-Asamoa, D. M. John, and H. N. Appler.
Hydrobiologia, Vol 76, No 3, p 191-200, 1980. 7 Fig, 1 Tab, 16 Ref.

Descriptors: *Periphyton, *Population dynamics, *Seasonal variation, *Volta Lake, *Ghana, Lakes, Nutrients, Algae, Cyanophyta, Chlorophyta, Diatoms, Species diversity, Water level, Nitrates, Ammonia.

The seasonal changes in periphyton growing on four flooded trees in the Volta Lake, Ghana, were studied for a year starting in October 1974. The quantitatively most important species of the 47 found were Navidula, Synedra, and Melosira (diatoms); Spirogyra, Oedogonium, and Stigeoclonium (green algae); and Oscillatoria and Anabaena (blue-green algae). The species diversity and cell numbers of diatoms and green algae were high in October and November, corresponding to a period of lake stabilization after the flood period. Species diversity and cell numbers rapidly declined with the drop in lake level over the dry season to a low in June-July. The blue-green algae and diatoms peaked in March-May, the early part of the wet season, when water was warmest (29.7 C) and pH was highest, 7.2. At this time the green algae were at a minimum. Nitrate was high during October-November (0.5 mg per liter) and during March-April (0.8 mg per liter), while ammonia was high in December-January (0.2 mg per liter). At the period of minimum lake level (July) some green filamentous algae began significant increases in cell number until September and declined with a rise in lake level. (Cassar-FRC)
W82-02882

PERIPHYTON IN THE VOLTA LAKE. II. SEASONAL CHANGES ON WOODEN BLOCKS WITH DEPTH,
British Museum of Natural History London (England). Dept. of Botany.
D. M. John, E. K. Obeng-Asamoa, and H. N. Appler.
Hydrobiologia, Vol 76, No 3, p 207-215, 1980. 4 Fig, 1 Tab, 13 Ref.

Descriptors: *Periphyton, *Population dynamics, *Seasonal variation, *Volta Lake, *Ghana, Algae, Cyanophyta, Chlorophyta, Diatoms, Species diversity, Water depth, Nitrates.

Periphyton were allowed to colonize and grow for one year on wooden blocks suspended at 0, 0.5, 1, 2, and 5 m in the Volta Lake, Ghana. Forty-seven species were recorded (26 diatoms, 9 green algae, and 10 blue-green algae). Diatoms were most numerous in the first 3 months (October to December, 1974) and again in the last month of the study. Green and blue-green algae, nearly absent for the first 3 months, increased in number as the year progressed. Green algae were the most numerous group after a year's growth. All numbers decreased with depth, especially below 2 m. species diversity of the 3 types of algae generally followed the cell number seasonal and depth patterns. Blue-green algae and diatom numbers increased in April-May with the higher levels of nitrate during the early rains. (Cassar-FRC)
W82-02883

OBSERVATIONS ON SOME COMMON PARASITES OF BAGRUS DOCMAC FORSKAHL (PISCES: SILUROIDEA) OF LAKE VICTORIA,
East African Freshwater Fisheries Research Organization, Jinja (Uganda).
G. B. Mbahinzireki.
Hydrobiologia, Vol 75, No 3, p 273-280, November, 1980. 5 Fig, 30 Ref.

Descriptors: *Lake fisheries, *Fish parasites, *Parasites, *Lake Victoria, Bagrus docmac, Fish series, Leeches, Nematodes, Crustaceans, Invertebrates, Fish farming, Catfish.

Specimens (1340) of Bagrus docmac Forskahl, an important commercial catfish in Lake Victoria, were examined for 3 common parasites: external crustaceans and leeches and internal nematode larvae. Almost every fish in the susceptible size group (16.0 cm) was infected with 1 or more types of parasites. Argulids were recovered from 36% of the samples. However, 88% carried 6 or less argulid parasites per fish. There was a positive correlation between fish size and argulid incidence; maximum was 37 on a 110.3 cm fish. Leeches occurred on only 4% of fish, but those infected had as many as 50. Leeches were especially common on fish living in water less than 10 m deep. Eustrongylides sp. and Contracaecum sp. were the most common nematodes, infecting 57% of the fish. Smaller fish (< 16.0 cm) had none or few of these parasites. Fish probably acquire the nematode larvae by ingesting prey. Possible pathological effects are: inflammation and sores on the skin and gills, poisoning from toxins, damage to internal organs, and impairment of digestion. Infected fish in the lake were in good condition (K = 3.12), but the overcrowded conditions common in fish farms could cause serious mortality. (Cassar-FRC)
W82-02887

ZOOPLANKTON OF LAKE TAUPO,
Department of Scientific and Industrial Research, Taupo (New Zealand). Ecology Div.
D. J. Forsyth, and I. D. McCallum.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 65-69, 1980. 6 Fig, 16 Ref.

Descriptors: *Zooplankton, *Lakes, *Lake Taupo, *New Zealand, Rotifers, Aquatic animals, Seasonal variation, Trophic level.

Seasonal changes in species composition and abundance of zooplankton were measured in Lake taupo at three sites each month from August 1974 to January 1976. The zooplankton were dominated by adult and immature stages of Boeckella propinqua Sars at 38.0%, the cladocerans Ceriodaphnia dubia Richard at 8.4% and Bosmina meridionalis Sars at 3.6%, and the cyclopoid copepod Macrocyclops albidus (Jurine) at 1.0%. These crustaceans made up 50.3% of the zooplankton, with the remaining 49.7% being rotifers. The most common rotifers were Polyarthra vulgaris (carlin) at 36.0% of the total zooplankton numbers, Conochilus coenobasis (Skorilow) at 10.3%, Asplachna brightwelli Gosse at 2.2%, and Hexarthra sp at 1.1%. Zooplankton populations were generally low in winter, increasing in spring and declining in autumn, in other parts of New Zealand. In Lake Taupo, however, numbers tended to be highest in autumn, mainly due to the greater number of rotifers caught with the small mesh size net used in this study. (Baker-FRC)
W82-02888

OCCURRENCE, DISTRIBUTION AND SEASONAL PERIODICITY OF SOME AQUATIC FUNGI OF SAT-TAL (NAINITAL), INDIA,
Kuman Univ., Naini Tal (India). Dept. of Botany.
G. S. Mer, S. C. Sati, and R. D. Khulbe.
Hydrobiologia, Vol 76, No 3, p 201-205, 1980. 2 Tab, 22 Ref.

Descriptors: *Fungi, *Seasonal variations, Aquatic fungi, Soil fungi, Distribution patterns, Microorganisms, *India, *Lakes.

Aquatic fungi (Blastocladiales, Saprolegnailes, Lagenidiales, and Peronosporales) were studied in 3 lakes and their surrounding soils in the Sat-Tal area of India. The 23 species were grouped into three categories according to occurrence (aquatic, amphibious, and terricolous) and three categories with respect to temperature range (low temperature, below 18C; moderate temperature, 18.1-26.8C; and constant species, 8-26.8C). The aquatic molds varied seasonally according to temperature. In water the highest number of species was observed in the rainy season and the minimum in other seasons, according to site. In soils, the aquatic fungi were most numerous in spring, summer, or the rainy season and least numerous in winter. (Cassar-FRC)
W82-02894

FACTORS INFLUENCING THE COMPOSITION, STRUCTURE AND DENSITY OF A POPULATION OF BENTHIC INVERTEBRATES,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Archiv fur Hydrobiologie, Vol 88, No 2, p 202-218, March, 1980. 5 Fig, 2 Tab, 46 Ref.

Descriptors: *Eutrophication, *Lakes, *Seasonal variation, *Species composition, *Benthic fauna, *Ecological effects, Algal growth, Aquatic animals, Aquatic populations, Midges, Oligochaetes, Molluscs, Subarctic zone, Water quality, Population density, Species diversity, Food chains, Littoral zone, Bays.

The composition, structure, and seasonal abundance of benthic invertebrate populations were studied in a eutrophic bay on the north shore of Great Slave Lake in the Canadian subarctic between May 1977 and May 1978. Shoreline communities consisted of 55 species, with predominant representations of chironomids, molluscs, and oligochaetes. During winter months, chironomids were most abundant, with maximum densities of 1500 larvae/sq m, while molluscs and oligochaetes nearly equaled each other in number throughout the year. Gut content analyses showed that there were few algae-eating microfaunal species in the summer. Offshore communities contained 46 species, of which chironomids and molluscs were predominant. Most offshore chironomids emerged 2 weeks later than their nearshore counterparts. Offshore herbivores subsisted mainly on detritus. It was concluded that the density of oligochaetes was correlated with algal abundance, and that the quantities of food ingested had little effect on benthic populations. Water quality had noticeable effects on species composition, while water temperature and sediment organic content affected emergence times of some species. (Geiger-FRC)
W82-02909

A CARLSON-TYPE TROPHIC STATE INDEX FOR NITROGEN IN FLORIDA LAKES,
California Univ., Los Angeles. Office of Environmental Science and Engineering.

For primary bibliographic entry see Field 5C.
W82-02911

SCREEN MESH SIZE AFFECTS ESTIMATES OF MACRO- AND MEIO-BENTHOS ABUNDANCE AND BIOMASS IN THE GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
T. F. Nalepa, and A. Robertson.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 9, p 1027-1034, September, 1981. 2 Fig, 7 Tab, 25 Ref.

Descriptors: *Benthos, *Lakes, *Great Lakes, *Biomass, Aquatic life, Measuring instruments, Sampling.

A study was performed to determine the relation of mesh size to sampling efficiency for Great Lakes benthic animals. The efficiencies of screens with meshes of two different sizes, 595 micrometers and 106 micrometers, in retaining the macro- and meiobenthos from Lake Michigan sediment samples have been determined. Samples were taken at nine stations in southeastern Lake Michigan near the mouth of the Grand River. The 595-micrometer screen was much less efficient in retaining chironomids and oligochaetes other than mature Limnodrilus. This coarse screen retained only about half of all chironomids. Obviously, the mesh size used to quantify the macrobenthos should vary with the purpose of the study. Retention of certain macrobenthic taxa was significantly related to sampling date and water depth, indicating that future studies concerned with these variables should use mesh sizes small enough to retain all of the individuals from the taxa of interest. (Baker-FRC)
W82-02912

BLUE-GREEN ALGAL AMMONIA UPTAKE IN HYPERTROPHIC PRAIRIE LAKES,
National Water Research Inst., Burlington (Ontario). Aquatic Ecology Div.
T. P. Murphy, and B. G. Brownlee.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 9, p 1040-1044, September, 1981. 3 Fig, 1 Tab, 19 Ref.

Descriptors: *Lakes, *Trophic level, *Ammonia, Nitrogen, Nutrients, Algal growth, Absorption, Prairies, *Manitoba, Canada, Kinetics.

It is proposed that N-uptake experiments can determine the degree of algal N demand and thus confirm that N limitation in the hypertrophic prairie lakes occurs only for short periods. The lakes chosen for this kinetic study are located in the Erickson-Elphinstone area of southwestern Manitoba, Canada. They have virtually unialgal compositions. The Aphanizomenon samples were at least 98% pure, and the Microcystis samples were at least 90% pure. Two types of ammonia uptake were noted in this study. Active uptake kinetics, a hyperbolic response to increased ammonia ion concentration, was encountered in water samples with low ambient ammonia. Saturation kinetics, a linear response to increased ammonium ion levels, was measured in samples collected with high ambient concentrations of ammonia. When the in situ ammonia-uptake velocity per unit particulate nitrogen of each Michaelis-Menten experiment was plotted as a function of the lake ambient ammonia concentration, the algal ammonia uptake was shown to adapt to the new nutrient levels. The adaptation shown by Aphanizomenon and Microcystis to changing ammonia ion cncentrations has important ecological consequences. The ability to take up large quantities of ammonia when or where it is concentrated and either grow quickly or use it later in ammonia-deficient water would give these algae a great competitive advantage. This could explain why blue-green algae dominate lakes with large but ephemeral supplies of ammonia but are unimportant in lakes with little ammonia. (Baker-FRC)
W82-02914

AMMONIA VOLATILIZATION IN A HYPERTROPHIC PRAIRIE LAKE,
National Water Research Inst., Burlington (Ontario). Aquatic Ecology Div.
T. P. Murphy, and B. G. Brownlee.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 9, p 1035-1039, September, 1981. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Trophic level, *Ammonia, Absorption, *Lakes, Volatility, Nitrogen cycle, Prairies, *Manitoba, Canada, Eutrophication, Kinetics, Storms, Water quality management, *Fishkill, Algal growth.

This paper proposes that some processes of the ammonia cycle can be mediated by weather, and that this is an important factor in the development or decline of phytoplantkton biomass. Lake 885 in the Erickson-Elphinstone area of southwest Manitoba, Canada was used, as it has a history of many algal bloom collapses. The lake has an area of 2.4 ha and a maximum depth of 2.9 meters. Ammonia uptake was measured with Michaelis-Menten kinetic analysis. The first storm event sampled was in a phosphorus-enriched limnocorral. The storm resulted in high ammonia concentrations only in the P limnocorral. There was a large increase in the number of akinetes and many of the Aphanizomenon flakes had separated into individual filaments. During two periods of high pH and high ammonia concentrations, ammonia disappearance rates of 20-30 micrograms N/liter/hour were noted. At these times rates of ammonia uptake by phytoplankton were 2.6-4.3 microgram N/liter/hour as measured by a N-15 method. The high excess rates of ammonia disappearance are best explained by volatilization of ammonia from the lake surface. The loss of ammonia induced nitrogen fixation; however, much larger quantities of ammonia were lost via ammonia volatilization after the algal bloom collapsed than the algae could fix in one season. (Baker-FRC)
W82-02915

THE EFFECT OF ALPHA-HYDROXYBENZYLMETHANESULFONATE ON PHOTOSYNTHESIS AND EXCRETION OF CHLORELLA AND NATURAL PHYTOPLANKTON IN A LAKE,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W82-02918

PHYSICOCHEMICAL INFLUENCES ON PHYTOPLANKTON PRODUCTION IN A TROPICAL ALPINE LAKE,
Hawaii Univ., Honolulu. Dept. of Botany.
J. E. Massey.
Archiv fur Hydrobiologie, Vol 91, No 2, p 133-143, May, 1981. 2 Fig, 5 Tab, 23 Ref.

Descriptors: *Phytoplankton, *Alpine regions, *Lakes, Tropic zone, Population dynamics, Nitrogen, Light intensity, Cycling nutrients, Nutrients, Eutrophication, *Hawaii.

The roles of the physical and chemical environments in primary production were explored, using a small tropical alpine lake as the study site. The lake was monitored during May through September of 1977 and is located at 3969 meters on the summit plateau of an extinct Hawaiian volcano. Lake Waiau is moderately productive by alpine standards. The shoreline was heart shaped with a maximum diameter of 73 meters and a total surface area of 0.60 ha. Maximum depth was 2 meters. Acidity ranged from 8.4 to 9.8. Water temperatures varied from 4.5 to 13.0 degrees C. Thermal stratification was not noted. Primary phytoplankton production ranged from 59.3 to 350.0 mgC/square meter/day. The maximum volumetric rate of carbon assimilation was 38.0 mg C/cubic meter/hour. Algal population composition was determined by chlorophyll concentrations and silicon depletion rates. The flora consisted of a few species of planktonic algae and an epilithic mat composed of Cyanophyta and some Chlorophytes. The photosynthetic capacity of the system did not vary significantly over the five month study period. Three regression models were developed to assess specific physical or nutritional influences and their interactive effects on production. Light levels, rate of nutrient cycling, and nitrogen concentrations appear to limit, whereas nickel may act to inhibit, phytoplankton production. (Baker-FRC).
W82-02921

COMPARISON OF STATISTICAL PHOSPHORUS-RETENTION MODELS,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5G.
W82-02930

THE SCHOOLING MECHANISM OF YOUNG PERCH (PERCA FLUVIATILIS) IN THE OPEN PART OF LAKE-TYPE RESERVOIRS (AS EXEMPLIFIED BY RYBINSK RESERVOIR),
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
V. K. Konobeyeva, A. G. Konobeyev, and A. G. Poddubnyy.
Journal of Ichthyology, Vol 20, No 2, p 49-62, 1980. 7 Fig, 3 Tab, 29 Ref.

Descriptors: *Fish behavior, *Intakes, *Reservoirs, Rybinsk, *USSR, *Perch, Lakes, Wind-driven currents.

A method of predicting the distribution of young fish was developed and tested on data from the Rybinsk Reservoir, USSR. The distribution of larvae is determined by wind currents and the bottom contour. The fish young, which move passively with water masses, are widely and evenly distributed during June and July. At the end of summer, fingerlings are passively carried into the sedimentation zones, where they remain with the maximum biomass of benthic invertebrates and plankton. The main areas where young fish aggregate may be predicted knowing the spawning places, time of mass hatching of the young, the velocity and direction of the wind currents, and the bottom contour at the time of aggregation. This information is helpful in placing water intakes to minimize fish mortality. Intakes must not be set up in zones of ooze accumulation, in the sheltered coastal zone with vegetation, in river mouths, or near main routes along which young fish are moved by the currents. (Cassar-FRC)
W82-02954

2I. Water In Plants

WINTER WATER RELATIONS OF RED SPRUCE ON MOUNT MONADNOCK, NEW HAMPSHIRE,
Harvard Univ., Cambridge.
D. T. Kincaid, and E. E. Lyons.
Ecology, Vol 62, No 5, p 1155-1162, October, 1981. 3 Fig, 1 Tab, 36 Ref.

Descriptors: *Water potentials, *Spruce trees, *Altitude, Seasonal variation, Temperature effects, *Mount Monadnock, *New Hampshire.

This study was designed to test the hypothesis of Baldwin (1977) that severe water deficits occur for red spruce and to determine whether stem water potential decreases with altitude and decreases cumulatively during winter. Also, the level (shoot, tree, altitude, season) where the greatest variability occurs in water status was determined, and the temperatures of tree tissues and microenvironments were measured at different altitudes. In addition, an electron scanning microscope was used to xamine old, dead, or exposed needles to determine cuticular damage. Water potential averaged -1.14 MPa for 545 shoots over two winters, indicating that severe dehydration did not occur. No clear trends were found between altitude and water potential, and the coldest collection days did not correspond to the lowest water potentials. A study of water potential variations of modular parts of single trees may be more useful. (Small-FRC)
W82-02634

MANAGEMENT OF SOIL WATER BUDGETS OF RECHARGE AREAS FOR CONTROL OF SALINITY IN SOUTH-WESTERN AUSTRALIA,

Western Australia Univ., Nedlands. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W82-02754

MINERAL NUTRIENT AVAILABILITY IN WATERCRESS BED SUBSTRATES,
Bath Univ. (England). School of Biological Sciences.
I. P. Cumbus, L. W. Robinson, and R. G. Clare.
Aquatic Botany, Vol 9, No 4, p 343-349, December, 1980. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Aquaculture, *Nutrients, *Watercress, *Substrates, Phosphates, Manganese, Nitrates, Calcium, Potassium, Magnesium, Iron, Zinc, Minerals.

Three commercial watercress beds were selected as experimental sites for a preliminary survey of mineral nutrient availability. Substrate water samples contained low levels of nitrate-nitrogen in comparison with surface waters at each site. This supports the finding that watercress crops are almost entirely dependent on surface irrigating water for their nitrate supply and therefore the water throughput must be maintained at a high level. Total nitrogen in shoot and root tissues from all three sites were above the tissue critical levels. Phosphorus concentrations in substrate waters were at least a factor of 10 greater than those in surface waters. Potassium levels were similar in both surface and substrate waters. Levels of calcium and magnesium at each site were higher in the substrate than in surface waters. Root systems of watercress penetrate the bed substrates and may use mineral nutrients within this environment. (Baker-FRC)
W82-02769

VERTICAL VARIATION IN STEMFLOW GENERATION,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Geography.
I. Hutchinson, and M. C. Roberts.
Journal of Applied Ecology, Vol 18, No 2, p 521-527, August, 1981. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Interception, *Stemflow, *Canopy, Trees, *Fir trees, Conifers, Simulated rainfall, Rainfall, Precipitation, Throughfall.

Stemflow resulting from simulated rainfall was measured at four heights (about 0, 1, 2, and 4 m from the base) on a 15-year old open grown Douglas fir tree, 9 m high. The branch interception area increased exponentially with the branch length, yielding a total interception area of 37.4 sq m. Total stemflow was less than 2% of the total precipitation (0.61 cm per hour for 1 hour, 0.77 cm per hour for 2 hours, and 0.41 cm per hour for 4 hours). Although the branches on the lower 2 m of trunk would be expected to produce 31% of the stemflow according to interception capacity, they were actually responsibile for only 1.7%. The branches attached between 2 and 4 meters on the trunk and the branches attached between 4 meters and the top contributed 58.2% and 40.1% of total stemflow, respectively. This pattern is caused by differences in the stem-branch angles, which are 70-80 degrees near the top and 80-90 degrees near the bottom. Lower branches are horizontal or drooping and thus contribute more to throughfall than to stemflow. (Cassar-FRC)
W82-02959

2J. Erosion and Sedimentation

MODELING RILL DENSITY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R-M. Li, V. M. Ponce, and D. B. Simons.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR1, p 63-67, March, 1980. 1 Fig, 4 Ref.

Descriptors: *Rills, *Turbulent flow, *Laminar flow, Model studies, Rainfall-runoff relationships, Channel flow, Erosion, Sediment yield, *Agricultural engineering, Erosion control.

The development of a rill density model would permit a quantitative estimate to be made of the factors influencing soil erosion and sediment yield, with important potential applications. Rill development is a complex physical process involving the interaction of hydrologic, geomorphic, and geotechnical components of the agricultural landscape. A mathematical formulation of rill density was developed, based on stream morphology concepts. The equations derived give the rilling density in laminar and turbulent flow as a function of the slope of the plane measured along a specific distance, threshold rainfall intensity, armoring diameter, and several constants for friction, transport and morphology. These equations agree with statements in the literature that rilling density increases with increasing threshold runoff rate and decreasing particle diameter. (Cassar-FRC)
W82-02604

RIVER AND SUSPENDED SEDIMENT DISCHARGE INTO BYAM CHANNEL, QUEEN ELIZABETH ISLANDS, NORTHWEST TERRITORIES, CANADA,
Pacific Geoscience Centre, Sidney (British Columbia).
For primary bibliographic entry see Field 2E.
W82-02637

EROSION RESISTANCE OF COHESIVE SOILS,
Rhode Island Univ., Kingston. Dept. of Civil Engineering.
W. E. Kelly, and R. C. Gularte.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY10, p 1211-1224, October, 1981. 8 Fig, 3 Tab, 31 Ref.

Descriptors: *Erosion, *Soil stability, *Cohesive soils, Creep strength, Shear stress, Mathematical studies.

The applicability of both the rate process and double layer theories to the erosion of cohesive soils was investigated. The results demonstrated the applicability and utility of the rate process theory for qualitatively describing surface erosion of cohesive soils. Interparticle bonds in both erosion and creep were found to be similar. Flow volumes depended primarily on salinity. Resistance to erosion was measured by the critical shear stress and exhibited the same dependency on the number of interparticle bonds per unit area as soil strength did. This interpretation may explain in part why attempts to relate erosion resistance to undrained shear strength have had only limited success. (Small-FRC)
W82-02676

RECENT INSHORE SEDIMENTS IN MUSANDAM, OMAN,
University Coll., London (England).
C. Vita-Finzi, and S. J. Phethean.
Marine Geology, Vol 36, No 3/4, p 241-251, July, 1980. 5 Fig, 2 Tab, 23 Ref.

Descriptors: *Organic carbon, *Sediments, Chemical composition, *Musandam Peninsula, North Oman, Carbon, Coasts, Sediment transport, Sediment distribution, Ephemeral streams.

The organic carbon content was investigated in sediments recovered from an expedition to North Oman on which grab samples were taken of some of the inlets and bays of the Musandam Peninsula. This peninsula forms the northern tip of Oman, in eastern Arabia, and is separated from Iran by the narrow Strait of Hormuz. It consists of a series of plateaus and headlands, separated by bays and fjord-like gulfs. The coast is bounded by steep cliffs which in places exceed 200 m in height. The bulk of the peninsula is underlain by the massive, gently-dipping limestones and dolomitic limestones of the Musandam Series, ranging in age from Triassic to Lower Cretaceous. The deepest parts of the Persian Gulf lie close to the Iranian shore, with depths of over 100 m occurring in the Strait of Hormuz. The samples were dominated by clay- and silt-sized particles with subordinate fine to coarse sand. Much of the silt consisted of comminuted skeletal material. The sand was partly skeletal in origin and contained foraminifers, ostracods, serpulid tubes and bivalve fragments. The organic carbon content ranged from 0.15 to 3.34% and is related to median grain size. Although in general texture it is related to water depth, the content of organic carbon is also influenced by distance from the open sea. The effect of terrigenous sedimentation is confined to the mouth of the area's major watercourse, the ephemeral Wadi al'Ayn, and to inshore areas supplied by the products of bioerosion. It is suggested that differential preservation, rather than supply, of organic carbon accounts for the observed distribution pattern. (Baker-FRC)
W82-02857

PALEOLIMNOLOGY OF LAKE KIZAKI,
Kyoto Univ. (Japan). Inst. of Paleolimnology and Paleoenvironment on Lake Biwa.
S. Horie, K. Yaskawa, A. Yamamoto, T. Yokoyama, and M. Hyodo.
Archiv fur Hydrobiologie, Vol 89, No 4, p 407-415, August, 1980. 6 Fig, 9 Ref.

Descriptors: *Sedimentology, *Paleolimnology, Sediment deposition, Volcanoes, *Lake Kizaki, *Japan, *Lake sediments, Glacial lakes.

Sediment cores of Lake Kizaki, Japan, revealed that this mesotrophic lake was once a closed body of water having a low deposition rate. At the 28 meter depth (at least 20,000 years old) a gravel bed, probably of glacial origin, was located. In the lower half of the core, 12 layers of volcanic ash were found by geomagnetic industry and bulk density measurements. Nine of the ash layers were 0.1-0.5 cm thick; the others ranged from 2 to 23 cm thick. (Cassar-FRC)
W82-02863

POST-GLACIAL SEDIMENTS IN LAKE LINNEVATN, SPITSBERGEN,
Oslo Univ. (Norway). Inst. of Limnology.
For primary bibliographic entry see Field 2H.
W82-02869

SOIL EROSION AND TOTAL DENUDATION DUE TO FLASH FLOODS IN THE EGYPTIAN EASTERN DESERT,
Cairo Univ., Giza (Egypt). Dept. of Natural Resources.
T. M. Labib.
Journal of Arid Environments, Vol 4, No 3, p 191-202, September, 1981. 6 Fig, 4 Tab, 31 Ref.

Descriptors: *Floods, *Soil erosion, *Denudation, Erosion, Sediment load, Sediment discharge, *Nile River, Egypt, Solute transport, *Flash floods, Deserts, Arid lands, Runoff, Suspended sediments, Deltas.

A sudden rain that fell on the whole eastern desert of Egypt on February 19 and 20, 1975, caused the Nile River to rise 2 meters and the suspended matter to increase to 3040 ppm (Feb. 23). Total precipitation input was estimated at 539,361 million cu meters. Flash flood water input to the river during the 20 day flood period was estimated at 454,200 million cu meters; total suspended load during the flood period, 1,850,811 tons; and total discharge of sediment carried to the Nile by the flash flood water 2,790,189 tons. Average solutes during the flood were 595 ppm, vs. 320 ppm non-flood. Dissolved solutes attributed to flash flood waters were 692,787 tons. The total sediment discharge for the 98,506 sq km area (3/4 of sediments reaching the Nile, 1/4 deposited in wadi) was 37.8 tons per sq km, higher than the average for the African continent (27 tons per sq km). Chemical denudation in the eastern desert was 9.4 tons per sq km; total denudation 42,858 cu meters per sq km per storm or 4 cm per 1000 years. The volume of the Nile cone was estimated, considering flash flood contributions over the last 25 million years, at a total of 191,760 cu km, with flash floods accounting for 16,000 cu km of this. The soil

erodibility factor was calculated at 0.05 tons per ha per storm. Only 8% of the precipitation reached the groundwater reservoir. Water conservation, diversion, and storage, as well as soil conservation including planting trees and crops and controlled grazing, are urgently recommended for the eastern desert region. (Cassar-FRC)
W82-02875

FLOW RESISTANCE IN COARSE GRAVEL BED RIVERS,
Ministry of Works and Development, Christchurch (New Zealand).
G. A. Griffiths.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY7, p 899-918, July, 1981. 2 Fig, 5 Tab, 41 Ref.

Descriptors: Flow, Rivers, *Channel flow, *River flow, *Friction loss, Hydraulics, Fluid mechanics, Critical flow, Gravel, Sand, River beds, *Sediment transport, *Bed load, Experimental design, Roughness, *Flow resistance.

Results of the study of two sediment transport regimes are presented. In one regime, the channel boundary is rigid, and in the other, the boundary is deformable. The study included a dimensional analysis of the two regimes, calibrated by linear multiple regression. It also included the collection of 136 field data sets from 72 reaches on 46 New Zealand gravel bed rivers. Results indicate that resistance to turbulent flow is primarily dependent on roughness under the rigid channel regime, and that resistance is primarily dependent on a mobility parameter under the deformable boundary regime. (Titus-FRC)
W82-02879

MAPPING SEDIMENT SOURCES IN A NEW ZEALAND MOUNTAIN WATERSHED,
Forest Research Inst., Christchurch (New Zealand).
M. P. Mosley.
Environmental Geology, Vol 3, No 2, p 85-95, 1980. 6 Fig, 2 Tab, 18 Ref.

Descriptors: *Sediment control, *Mapping, *Surveys, Watershed management, Sediment loads, *Sedimentology, Sediment distribution, Mountain lakes, New Zealand.

A survey technique was developed to provide an inventory of sediment sources, where sediment sources are classified in terms of geomorphic type and degree of activity or severity. The procedure, originally developed by the New Zealand Ministry of Works, was refined, tested for validity and reproducibility, and evaluated for research and management purposes. The Harper-Avoca River, Canterbury, was studied, as this is a major water supply source for the Lake Coleridge power scheme and has had problems with sediment load. Over 700 individual sediment sources were identified and mapped in the watershed, requiring 15 days in the field. The techniques provided useful information on the locations of major sources of sediment and on the relative importance of each feature. Thus, sites whose treatment or control would bring the most benefit in reducing sediment loads were identified. (Small-FRC)
W82-02885

THE VARIATION IN SUSPENDED SEDIMENT AND WATER PROPERTIES IN THE FLOOD-WATER FRONT TRAVERSING THE TIDAL FLAT,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
For primary bibliographic entry see Field 2L.
W82-02928

EROSION CONTROL ALONG TRANSPORTATION ROUTES IN NORTHERN CLIMATES,
Komex Consultants, Ltd., Calgary (Alberta).
F. B. Claridge, and A. M. Mirza.
Arctic, Vol 34, No 2, p 147-157, June, 1981. 12 Fig, 1 Tab, 3 Ref.

Descriptors: *Erosion, *Engineering, Permafrost, Erosion control, Erosion rates, Revegetation, Frozen ground, North America, Cold regions.

Erosion problems encountered in the planning of roads and pipelines for the transmission of natural gas and oil along routes in Northern climates in North America are considered. Erosion involves the physical and chemical weathering of rock and the transport and deposition of unconsolidated materials by water and wind action, gravity and thermal processes. The rate of erosion is affected by soil type, climate, vegetation, and drainage basin characteristics. Various construction activities contribute directly to erosion. Hydraulic erosion is caused by rainfall and flowing water. The loosening and transport of soil particles results from surface runoff occurring as channelized flow or sheet flow. Susceptibility of an exposed site to hydraulic erosion depends primarily on the soil properties, slope and corresponding flow velocities. Silts and fine sands low in cohesion are most susceptible to erosion. Gravels are much less susceptible because of the large sizes of particles. Although clays are finer in grain size, they are often less susceptible to erosion than are silts and sands, owing to their structure and cohesion. Most instances of severe erosion occur when drainage is uncontrolled through an area of ground disturbance. Where the ground cover has been disturbed or removed, subsidence and entrapment of water may follow, leading to ponding which can accelerate the degradation of permafrost. If water begins to flow, hydraulic erosion may follow and result in the formation of erosion gullies. Erosion control efforts are discussed, including granular blankets, channel liners, ditch checks, rock aprons and energy dissipators, and siltation basins. (Baker-FRC)
W82-02933

BED LOAD DISCHARGE COEFFICIENT,
National Water Research Inst., Burlington (Ontario). Hydraulic Research Div.
P. Engel, and Y. L. Lau.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1445-1454, November, 1981. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Bed load, *Discharge coefficient, Flow discharge, Sediment load, *Sediment transport, Sedimentation, Bottom sediments, Dunes, Dimensional analysis, Flow separation, Flow velocity, Flow pattern, Flow measurement, Sand, Multiphase flow.

The bed-load discharge coefficient for the case of two-dimensional flow over dunes is expressed in terms of bed-form geometry and the sand size of the bed material using dimensional analysis. Experiments were conducted in a rectangular flume using artificial dunes and a flow visualization method to measure the flow separation length, from which the bed-load coefficients were determined. The results of the study indicated that the position of zero transport on the back of a dune varies with the steepness of the dunes and the grain size of the bed material. The bed load coefficient is quite sensitive to changes in dune steepness and, to a lesser degree, to changes in grain size of the bed material. When dunes are flat, the effect of grain size on the bed load coefficient is significant. When dunes are steep, the coefficient depends on dune steepness only. The use of the bed load coefficient resulted in some improvement by decreasing the overall average error in a set of 10 separate flume tests. The value of the bed load coefficient K = 1.32 as used by Engel and Lau appears to be a special case representing the value for maximum dune steepness of 0.006. The application of the bed-load coefficient results in some improvement in estimating bed load. (Baker-FRC)
W82-02936

2K. Chemical Processes

FLUORESCENCE SPECTRA OF WATER-SOLUBLE HUMIC MATERIALS AND SOME POTENTIAL PRECURSORS,
Academy of Natural Sciences of Philadelphia, Avondale, PA. Stroud Water Research Center.
R. A. Larson, and A. L. Rockwell.
Archiv fur Hydrobiologie, Vol 89, No 4, p 416-425, August, 1980. 2 Fig, 3 Tab, 24 Ref.

Descriptors: *Streams, *Fluorescence, *Humic acids, *White Clay Creek, *Pennsylvania, Springs, Microbial degradation, Degradation, Organic matter, Chemical reactions, Lignin, Coumarin, Dissolved organic matter.

Fluorescence characteristics of water samples from White Clay Creek, Pennsylvania, and its tributaries differed among the 6 sites studied. Water from the spring at the source showed fluorescence spectra similar to those of substituted cinnamic acids and partly degraded lignins. Further downstream in the third-order stream reach, samples had spectra characteristic of coumarins. Photooxidation of caffeic acid (3,4-dihydroxy cinnamic acid), concentration 0.18-18 ppm, produced a 36% yield of esculetin (6,7-dihydroxy coumarin) within 1.5 hours. A combination of biotic processes, such as lignin degradation, and abiotic processes, such as sediment adsorption, may contribute to the changes in dissolved organic matter fluorescence in the downstream direction. Lignin biodegradation forms catechols, which may undergo radical coupling, ring cleavage, quinone formation, and other chemical reactions to produce cis-cinnamic derivatives, which lactonize to coumarins. (Cassar-FRC)
W82-02648

DISSOLVED IODINE FLUX FROM ESTUARINE SEDIMENTS AND IMPLICATIONS FOR THE ENRICHMENT OF IODINE AT THE SEDIMENT WATER INTERFACE,
Chicago Univ., IL. Dept. of Geophysical Sciences.
W. J. Ullman, and R. C. Aller.
Geochimica et Cosmochimica Acta, Vol 44, No 8, p 1177-1184, 1980. 5 Fig, 1 Tab, 50 Ref.

Descriptors: *Iodine, *Sediment-water interfaces, Interfaces, Halogens, Fluctuations, *Estuaries, Chemical reactions, Sediments.

Some of the diagenetic redistribution processes are examined which influence the distribution of iodine in surficial earth environments, with emphasis on the sediment-water interface. Rates of exchange of dissolved iodine between sediment and overlying water are determined, and the transport-reaction regime that these rates must reflect is elucidated. Sediment and water samples used in the study were obtained from a station in Mud Bay, South Carolina. Mud Bay is a shallow, muddy embayment on the north side of the larger and deeper Winyah Bay of 10 to 12 meters in maximum depth. Surface water salinity is highly variable, but a mean chlorinity of about 0.25M is evident from pore water profiles taken from 1 meter length cores. The yearly temperature range is about 6-30 degrees C. The results show that the flux, pore water and production rate data are consistent with the release of iodine into solution during the anaerobic decomposition of organic matter. The exponential decrease of the production rate with depth in sediment is similar to that found for the release rates of other mineralized organic constituents such as nitrogen and with the general distribution of microbial metabolic activity in sediments. Flux estimates ranged between about 5 and 41 micromoles per square meter per day. These estimates, predicted from either the pore water iodine concentration gradient across the sediment-water interface or the dissolved iodine production rate, were higher than the apparent flux measured directly at the same site. This suggests that iodine which is released to the pore water under the anoxic conditions below the sediment surface reacts with a sedimentary component at or near the sediment-water interface and is lost from solution. (Baker-FRC)
W82-02656

MULTIVARIATE ANALYSIS AND GEOCHEMICAL INTERPRETATION OF SPATIAL VARIABILITY OF THE WATER QUALITY OF SOUTHERN QUEBEC RIVERS. (ANALYSE MULTIVARIEE ET INTERPRETATION GEO-

CHIMIQUE DE LA VARIABILITE SPATIALE DE LA QUALITE DE L'EAU DES RIVIERES DU QUEBEC MERIDIONAL),
Quebec Univ., Sainte-Foy.
B. Bobee, M. Lachance, and L. Potvin.
Journal of Hydrology, Vol 53, No 1/2, p 95-116, September, 1981. 5 Fig, 2 Tab, 12 Ref.

Descriptors: *Statistical analysis, *Geochemistry, *Rivers, Water analysis, Variability, *Chemical analysis, *Quebec, Water pollution sources, Chemical composition, Solutes, Water quality.

Correspondence analysis was used to analyse the spatial variability of a group of parameters measured at 62 sampling sites along southern Quebec (Canada) rivers. The parameters were conductivity and content of calcium, magnesium, sodium, potassium, sulphate, chloride, and silica. A clustering method was applied to the results of correspondence analysis, which led to the definition of four homogeneous zones. Three of the zones corresponded to the Laurentian Plateau, the Appalachian Mountains, and the St. Lawrence Lowlands. The fourth overlaps the appalachian Mountains and the St. Lawrence Lowlands. The behavior of each zone was related to the topography and geological characteristics of its geographical location. (Small-FRC)
W82-02662

DETERMINATION OF THE SOLUBILITY OF FERROUS SULFIDE IN A SEASONALLY ANOXIC MARINE BASIN,
Freshwater Biological Association, Windermere (England).
W. Davison, and S. I. Heaney.
Limnology and Oceanography, Vol 25, No 1, p 153-156, January, 1980. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Marine environment, *Sulfides, Basins, Limnology, *Iron, Seasonal variation, Temperature effects, Ferrous sulfide.

Measurements were made of iron (II) and sulfide levels for a seasonally anoxic marine basin. Water samples were taken at a moored site over the deepest part of the basin in September of 1978. Dissolved oxygen, temperature and turbidity were measured on site. Sulfide was measured polarographically and spectrophotometrically. Total iron was measured by acid digestion and spectrophotometric measurement of the iron chloride complex, and alkalinity was determined by Gran titration. The pH of the residue was measured with an electrode system. The field observations suggested that ferrous sulfide saturation would most probably be achieved in waters deeper than 19 meters. Sampled water initially looked clear, but on standing for 1 to 2 hr, developed a fine black precipitate. This change in appearance could be due either to the fine colloidal ferrous sulfide originally present becoming visible as its particle size increased or to fresh precipitation of ferrous sulfide. The latter would result from either a genuine solubility change on exposure to atmospheric temperature and pressure or shock-induced precipitation of a slightly supersaturated water. It was concluded that in dynamic seasonally mixed systems, irrespective of the ionic strength, the effective solubility of ferrous sulfide is similar to the measured value for freshly formed amorphous ferrous sulfide. (Baker-FRC)
W82-02665

CHEMISTRY OF A 7.5-M SEDIMENT CORE FROM LAKE VALENCIA, VENEZUELA,
Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology.
For primary bibliographic entry see Field 2H.
W82-02745

ANALYSES OF SOLUTE DISTRIBUTIONS IN DEEPLY WEATHERED SOILS,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
A. J. Peck, C. D. Johnston, and D. R. Williamson.
Agricultural Water Management, Vol 4, No 1/3, p 83-102, 1981. 8 Fig, 1 Tab, 25 Ref.

Descriptors: *Solute transport, *Salinity, Water quality, Water resources development, Soil properties, Erosion, Chlorine, Salts, Farming, Chemical analysis, Saline soils, *Australia.

The storage and distribution of solutes in lateritic soils and deeply weathered materials which blanket the Archean shield of granitic and gneissic rocks in Western Australia are discussed. Methods for the analysis of solute distributions in soil profiles are considered and applied to the examination of data from boreholes representative of those in the area. At borehole sites 1551 and 8251 there is evidence to support chloride ion flux densities at depths between 11 and 17 meters which are less by factors 6 and 12 respectively than the local average rates of chloride ion deposition in rainfall. In these regions it is concluded that there are spatially uniform water flux densities. This flux density is negligible at site 8251, so that diffusion is the dominant chloride ion transport mechanism in this part of the profile. At site 1551 the water flux density between 10 and 18 meters is estimated to be -0.5 mm per year. The small upward flux of water at this site reflects net discharge from the permanent groundwater which is consistent with the site location in a gentle saddle. (Baker-FRC)
W82-02764

EFFECTS OF SHORT-TERM CHANGES IN RAIN WATER SUPPLY ON THE IONIC COMPOSITION OF ACID MOORLAND POOLS IN THE CAMPINE OF ANTWERP (BELGIUM),
For primary bibliographic entry see Field 2H.
W82-02775

IRON AND MANGANESE IN LAKE VECHTEN (THE NETHERLANDS): DYNAMICS AND ROLE IN THE CYCLE OF REDUCING POWER,
Institute of Limnology, Nieuwersluis (Netherlands).
H. Verdouw, and E. M. J. Dekkers.
Archiv fur Hydrobiologie, Vol 89, No 4, p 509-532, August, 1980. 12 Fig, 8 Tab, 22 Ref.

Descriptors: *Iron, *Manganese, *Chemical reactions, Heavy metals, Metals, Sediments, Lake sediments, *Lake Vechten, *Netherlands, Lakes, Hypolimnion, Deposition, Sediment transport, Chemical precipitation, Solubility, Chaoborus, Stratification.

Concentrations of iron and manganese were measured in the hypolimnion and sediments of Lake Vechten, The Netherlands, maximum depth 10.5 m, during March-November 1973, 1974, and 1975. Fe levels in the hypolimnion ranged from zero at the beginning and end of the sampling season to 20-22 mg per liter in September at the 10 m depth. Mn levels in the hypolimnion ranged from a low of 0.5 mg per liter to 4.5-7.5 mg per liter in September at the 10 m depth, and from 0-6.5 mg per liter at 9 m. The water was supersaturated with respect to $FeCO_3$ from the bottom to 9 m and for $MnCO_3$ up to 8 m. Total Fe concentrations in the sediments were 7.2-14.1 mg per g wt weight; Mn concentrations, 0.19-0.41 mg per g wet weight. Lowest levels of total metals were found in the surface sediments, 0-3 cm, and highest levels in the deepest, 9-12 cm. About 4-6% of Fe and 10-20% Mn were in exchangeable form, and 0.3-0.5% Fe and 1.2-2.0% Mn were dissolved in the interstitial water. Of the total Fe and Mn found in the 0.12 cm sediment layer, only 1% Fe and 25% mN were released to the hypolimnion. It was concluded that at least 12 cm of the upper sediment must be involved in interaction with the overlying water. A probable mechanism is perturbation by Chaoborus flavicans larvae. The reducing power represented by the Fe/Mn system was about 0.5% of primary production, and sulfate reduction, about 1%. (Cassar-FRC)
W82-02864

METEOROLOGICAL INTERPRETATION OF THE CHEMICAL COMPOSITION OF RAINWATER AT ONE MEASURING SITE,
Utrecht Rijksuniversiteit (Netherlands). Inst. voor Meteorologie en Oceanografie.
W. A. H. Asman, J. Slanina, and J. H. Baard.
Water, Air, and Soil Pollution, Vol 16, No 2, p 159-175, August, 1981. 5 Fig, 6 Tab, 19 Ref.

Descriptors: *Rainfall, *Mathematical studies, Wind, Coasts, Meteorological data collection, Coastal waters, Rain, Nitrogen compounds, Hydrogen ion concentration, Air masses, Rainfall rate, *Water pollution sources, *Netherlands, Rain water, Chemical composition.

During 42 periods of 2 or 3 days each at one coastal site of the Netherlands, rainwater levels of H, NH4, Ca, Mg, K, Na, SO4, NO3, Cl, F, Pb, Fe, Br, Mn, V and Al were determined. No clear correlations were found between the coefficients of variation in the amounts of rainfall and the wind speed. When the air mass originates from the land (continental period), rainwater shows a larger concentration of terrestrial components. When the air mass comes from the sea (maritime period), the concentration of marine components is greater. Other meteorological factors had only minor effects on the chemical composition of rainwater. Nitrate and nitrite compounds were responsible for generating about 36% of the H-ions in rainwater. The most important neutralizing agent was NH3. When there was no neutralization by NH3 during continental periods, levels of H were about 2.55 times greater. A chemical definition of the continentality of rain is given and applied to rain samples collected during a meteorological event. (Geiger-FRC)
W82-02874

A SEDIMENT TRAP EXPERIMENT IN FUNKA BAY, JAPAN: 'UPWARD FLUX' OF PARTICULATE MATTER IN SEAWATER,
Hokkaido Univ., Hakodate (Japan). Dept. of Chemistry.
S. Tsunogai, M. Uematsu, N. tanaka, K. Harada, and E. Tanque.
Marine Chemistry, Vol 9, No 4, p 321-334, August, 1980. 5 Fig, 5 Tab, 22 Ref.

Descriptors: *Marine sediments, *Suspended sediments, *Bottom sediments, Bays, Fluctuations, Sampling, Sedimentology, *Funka Bay, Japan.

Settling matter was collected from Funka Bay, Japan, and the results were compared with other particles found in sea water, such as suspended particles and plankton. Analysis of this data lead to the development of an hypothesis for the transport of suspended substances in the marine environment. The existence of an upward flux of particulate matter is proposed, where the ascending paticles are not resuspended old bottom sediments. When the material obtained in the traps was analyzed for metals, organic elements, and radionuclides together with the suspended material in the water column, tow groups with different downward fluxes were determined. One group had a small flux that increased with depth, while the other had a rather constant large flux which was observed only in winter. The specific activity of 243Th did not decrease in winter, indicating that the large winter flux was not caused by resuspension of bottom sediments. Thus, the downward flux is not a net removal rate, and there must be an upward particulate flux in the bay. (Small-FRC)
W82-02893

KINETICS AND PRODUCT OF FERROUS IRON OXYGENATION IN AQUEOUS SYSTEMS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Environmental Engineering Science.
W. Sung, and J. J. Morgan.
Envirnomental Science and Technology, Vol 14, No 5, p 561-568, May, 1980. 9 Fig, 5 Tab, 28 Ref.

Descriptors: *Iron compounds, *Oxidation, *Kinetics, Chemical reactions, Oxygenation, Saline water, Seawater, Lepidocrocite.

The effects of ionic media, alkalinity, and temperature on the kinetics of ferrous iron oxygenation and the chemical nature of oxidation products were studied. This knowledge is of interest to the fields of water supply and treatment, wastewater, limnology, and oceanography. Solutions of $NaClO_4$,

NaCl, and Na2SO4, each buffered with bicarbonate-CO2, were used. For solutions of pH less than 7, the general rate law was found to be consistent with earlier work: -d times concentration of ferrous ion/dt = k times concentration of hydroxyl ions squared times P02 times concentration of ferrous ion, where k is the rate constant and PO2 is the oxygen pressure in atmospheres. Increases in ionic strength increase oxidation times, and increases in temperature decrease oxidation times. At pH 6.5-7.2 oxygenation half times are in the sequence SO4 > Cl > ClO4 for constant ionic strength. This explains the observation that ferrous ion oxidation in seawater is usually 100 times slower than in fresh water compositions. For pH greater than 7, kinetic data show catalysis of aqueous ferrous ion disappearance by the reaction product, which was identified by infrared spectra and X-ray diffraction as gamma-FeOOH, or lepidocrocite. These findings help explain the reported differences in ferrous ion behavior in fresh, estuarine, and marine waters. (Cassar-FRC)
W82-02923

AN ANALYSIS OF THE FIRST YEAR OF MAP3S RAIN CHEMISTRY MEASUREMENTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
M. B. Baker, D. Caniparoli, and H. Harrison.
Atmospheric Environment, Vol 15, No 1, p 43-55, 1981. 11 Fig, 1 Tab, 13 Ref.

Descriptors: *Rain, *Chemical analysis, Model studies, Sulfates, Nitrates, *Water pollution sources, *Acid rain, Acidity, Sampling, Meteorological data collection, Data collection.

General considerations are presented of the sampling problems inherent in rain chemistry measurements, along with an analysis of preliminary data from four stations of the Multistate Atmospheric Power Production Pollution Study (MAP3S). A primitive theoretical model of the scavenging of certain kinds of pollutants, notably sulfates, is reviewed, in which the variable nature of the removal precesses is explicitly considered and from which are derived certain measurement priorities. A description of the MAP3S data from the first year of operation is offered, along with an analysis of the available data and conclusions and recommendations for improved network design. The analysis of rain chemistry measurements from the MAP3S program has given numerical values for parameters of theroetical models of wet deposition of sulfur in general agreement with values estimated earlier for Western Europe. Thus, the probability of rain is about equal to 0.12, the characteristic rainout rate is about 0.3/hr, and the residence time for atmospheric sulfur species is about 100 hr. Both sulfate and nitrate affect the pH readings at all stations. Factor analyses and meteorological analysis of selected high deposition events revealed inadequacies in the present reporting and collecting procedures. Without adequate meteorological data and ambient vertical concentration profiles, the rain chemistry data will be of only limited value. (Baker-FRC)
W82-02934

2L. Estuaries

DISSOLVED IODINE FLUX FROM ESTUARINE SEDIMENTS AND IMPLICATIONS FOR THE ENRICHMENT OF IODINE AT THE SEDIMENT WATER INTERFACE,
Chicago Univ., IL. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 2K.
W82-02656

NONTIDAL CIRCULATION AND MIXING PROCESSES IN THE LOWER POTOMAC ESTUARY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
A. D. Hamilton, and R. E. Wilson.
Estuaries, Vol 3, No 1, p 11-19, March, 1980. 10 Fig, 4 Tab, 10 Ref.

Descriptors: *Estuaries, *Nontidal currents, *Mixing, Destratification, Currents, Salinity, Potomac River estuary, Rivers, Eddies, Water currents.

Current meter and hydrographic data collected over a 60 kilometer reach of the lower Potomac River Estuary from Dahlgren to Lewisetta, Virginia were analyzed. Attempts were made to relate variations in estimates for vertical eddy viscosity and eddy diffusivity to variations in Richardson number and to relate variations in the shear effect to variations in Richardson number. Over the length of this reach there is both a marked increase in stratification and a substantial decrease in tidal current amplitude toward the seaward end. The analysis suggests that values for vertical eddy viscosity and eddy diffusivity scale with water depth, tidal current amplitude and bulk Richarson number according to conventional empirical formulas. However, the constant which relates the vertical eddy coefficients under conditions of neutral stability to the product of water depth and tidal current amplitude is found to be an order of magnitude less than that expected for tidal conditions. Analyses also suggest that the degree of enhancement of longitudinal dispersion by the shear effect associated with the nontidal currents is a strong function of bulk Richardson number. (Baker-FRC)
W82-02657

ON MODELING THE TURBULENT TRANSPORT OF PASSIVE BIOLOGICAL VARIABLES IN AQUATIC ECOSYSTEMS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
J. S. Wroblewski, and J. J. O'Brien.
Ecological Modelling, Vol 12, No 1, p 29-44, March, 1981. 10 Fig, 38 Ref.

Descriptors: *Turbulent flow, *Hydrologic models, *Cycling nutrients, *Eddy diffusion, *Upwelling, *Ocean circulation, Phytoplankton, Ecosystems, Mixing, Limiting nutrients, Euphotic zone, Advection, Aquatic drift, Velocity, Vertical flow, Model studies.

Turbulence in aquatic ecosystems is recognized as an important factor for nutrient and phytoplankton mixing to enhance primary production in the lighted zone. The present work demonstrates that plankton models which incorporate time-dependent, mixed layer dynamics in their velocity fields give rise to an implicit turbulent flux of passive scalars, making complex formulations of the eddy diffusivity unnecessary. An Oregon upwelling ecosystem model is used to calculate the complex eddy diffusivity which would be needed to replace incorporations of realistic advection. The use of this substitution is not recommended. Ways in which an apparent negative eddy diffusivity may arise in advective plankton models and create gradients in biological fields are illustrated. (Geiger-FRC)
W82-02661

ACOUSTIC REFLECTION FROM ESTUARINE PYCNOCLINES,
Western Australian Inst. of Tech., South Bentley. Dept. of Physics.
J. D. Penrose, and T. Beer.
Estuarine, Coastal and Shelf Science, Vol 12, No 3, p 237-249, March, 1981. 3 Fig, 1 Tab, 24 Ref.

Descriptors: *Estuarine environment, *Acoustics, Stratification, Estuaries, Pycnocline, *Plankton, Zooplankton, Salinity, Temperature effects, Remote sensing, Sounding, Population density, Sound waves, Moore River, Australia.

The nature of acoustic back scattering from pycnoclines and appropriate scattering centers was investigated in order to comment on the performance of echo sounding as a sensing tool for mid-water layered plankton populations in an estuarine environment. The Moor River was used as a test site, as it is one of a number of Western Australian river-estuary systems which form well defined pycnoclines during at least part of the year. Several trips were made to the site, where acoustic reflection from a mid-water layer was noted on an echo sounder, measurements were made of temperature and salinity in the water column, and an assessment of plankton density was formed. The site yielded a relatively sharp, well defined pycnocline with a backscatter signal equivalent in magnitude to that expected from a single -86 dB target in the beam center, at the level of the pycnocline. Such a target strength could arise, at 200 kHz, from large zooplankton and at higher frequencies, from smaller organisms. The acoustic reflectivity from an estuarine pycnocline which is diffusion-controlled could be expected to drop with frequency because of the graded interface mechanism discussed. These findings suggest that by the use of very high sounder frequencies, the contribution of zooplanktonic scatters to the return echo can be made to exceed that due to the impedance contrast provided by temperature salinity variation with depth. In many estuarine situations, some degree of turbulence of various origins may be compatible with a recognizable pycnocline structure. The effect of such turbulence on acoustic echo formation needs further study. (Baker-FRC)
W82-02722

ON THE ALGAL ECOLOGY OF THE LOWLAND IRAQI MARSHES,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
For primary bibliographic entry see Field 6G.
W82-02777

SOME FIELD MEASUREMENTS CONCERNED WITH THE BEHAVIOR OF RESISTANCE COEFFICIENTS IN A TIDAL CHANNEL,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. W. Knight.
Estuarine, Coastal and Shelf Science, Vol 12, No 3, p 303-322, March, 1981. 20 Fig, 20 Ref.

Descriptors: *Estuaries, *Shear stress, Resistance, Tidal effects, Tidal rivers, Coastal waters, Mathematical models.

Analytical, field and laboratory studies were undertaken of the nature of resistance in unsteady open channel flow. The studies were carried out on a 1.2 km reach of the Conwy Estuary, North Wales, and were measurements made of the local resistance and dispersion parameters under varying tidal and fluvial conditions. Along the entire length of the estuary additional measurements of water level, velocity, salinity and water quality parameters were also taken for the purpose of modeling the entire system. The variations in the five terms of the unsteady flow equation throughout a tidal cycle were illustrated and an assessment made of their relative importance. The water surface slope term was the dominant one except for an hour either side of high slack water. The Manning and Darcy-Weisbach resistance coefficients for the 1.2 km test reach varied significantly with stage, particularly towards low water. At high values of stage, Manning's n was approximately constant around 0.028. The longitudinal density gradient term was important in that without it a marked hysteresis effect was noted on certain tides. The Nikuradse roughness height varied with stage, increasing from 0.2 meters at high water to a value comparable to the depth at low water. Computed values of shear velocity and boundary shear stress were within generally accepted values. It is advised that selecting a single roughness parameter to represent conditions in an individual element of a one-dimensional model is not wise. A stage-dependent resistance coefficient would represent a wide range of tidal conditions. (Baker-FRC)
W82-02792

PLANKTON STUDIES IN SAN FRANCISCO BAY. I. CHLOROPHYLL DISTRIBUTIONS AND HYDROGRAPHIC PROPERTIES OF THE SAN FRANCISCO BAY ESTUARY, JULY 1977 - DECEMBER 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
A. E. Alpine, J. E. Cloern, and B. E. Cole.
Available from OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $19.50 in paper copy, $3.50 in microfiche. Geological Survey

Open-File Report 81-213, February, 1981. 150 p, 1 Fig, 5 Tab, 8 Ref, Append.

Descriptors: *Estuaries, *Phytoplankton, *Chlorophyll, Biomass, Population dynamics, Data collections, Sampling, Sites, *San Francisco Bay, California, Water quality, Salinity, Turbidity, Water temperature.

This report summarizes the distribution of phytoplankton biomass and selected hydrographic properties measured in the San Francisco Bay Estuary, on a near-monthly basis, from July 1977 through December 1979. Parameters measured were: chlorophyll a, phaeopigments, in-vivo fluorescence, turbidity, size distribution of phytoplankton, salinity and temperature. (USGS)
W82-02831

PLANKTON STUDIES IN SAN FRANCISCO BAY. II. PHYTOPLANKTON ABUNDANCE AND SPECIES COMPOSITION, JULY 1977 - DECEMBER 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. L. J. Wong, and J. E. Cloern.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Price: $13.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-214, February, 1981. 103 p, 1 Fig, 3 Tab, 20 Ref, 5 Append.

Descriptors: *Estuaries, *Phytoplankton, *Taxonomy, Biomass, Population dynamics, Data collections, Sampling, Sites, *San Francisco Bay, California, Nutrients, *Ecological effects, Fish, Invertebrates, Hydrogen ion concentration, Dissolved oxygen, Water quality.

Data are presented on the phytoplankton species composition and abundance in San Francisco Bay from July 1977 through December 1979. Phytoplankton identification and enumerations were made at selected stations. Sample collections were made at selected stations in the main channel of the Bay from Rio Vista on the Sacramento River to Calaveras Point in South San Francisco Bay, and at shoal stations in the central portion of South San Francisco Bay, San Pablo Bay, and Suisun Bay. Also reported, from October 1978 through December 1979, are the calculated phytoplankton carbon and percent nondiatom carbon, and the species list. This study is one component of an ongoing interdisciplinary study of San Francisco Bay. (USGS)
W82-02832

DEVELOPMENT OF THE RIVER SEINE ESTUARY: CASE STUDY,
Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
F. Parthiot.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1283-1301, November, 1981. 5 Fig, 10 Ref.

Descriptors: *Model studies, *Estuaries, Estuarine environment, Rivers, *Seine River, France, Tides, Water currents, Waves, Field studies, Mathematical models, Case studies.

The study of an estuary is described on a movable bed scale model; the study began in 1950 and still continues. In spite of the schematic way in which this movable bed model represents the actual phenomena of nature, it is a true measuring apparatus, which is altogether accurate, sensitive and representative. The designing, building, calibrating and operation of the model are described to provide valuable information for designing of the channel training works completed in 1963. After the first success, a new version of the model was built in 1967 with certain changes in detail; this continues to serve for studies of development works in the estuary up to the present time. Hydraulic and sedimentological characteristics of the estuary are described, as well as the model design criteria which led to the choice of scales and bed material. Other modeled features include waves, tides, and offshore current. The calibration tests included the successful reproduction of the natural evolution of the estuary, observed over a period of almost 100 years. The conclusion demonstrated how optimum efficiency can be achieved by using a mathematical model of estuary tides and currents in combination with a movable bed scale model. (Baker-FRC)
W82-02867

SEASONAL SALINITY VARIATIONS IN CLEVELAND BAY, NORTHERN QUEENSLAND,
James Cook Univ. of North Queensland, Townsville (Australia). School of Biological Sciences.
T. Walker.
Australian Journal of Marine and Freshwater Research, Vol 32, No 1, p 143-149, 1981. 5 Fig, 11 Ref.

Descriptors: *Salinity, *Runoff volume, *Evaporation, Estuaries, *Cleveland Bay, Burdekin River, *Australia, Great Barrier Reef, Lagoons, Rivers, *Seasonal variation.

Salinity was determined weekly on the surface and at 1 meter from the bottom at various stations in Cleveland Bay, Australia, during the period July 1976 to August 1979. Salinity varied from year to year and from season to season. There was a correlation between minimum salinity (27 to 33 o/oo) and high river discharge during rainy periods, generally January-March. Salinities remained high (35-36 o/oo) during the dry months from about September to the beginning of the rainy period. Maximum differences between surface and bottom salinities were no greater than 1 o/oo in a wet year and 0.1 o/oo in a dry year. During the dry months the surface salinity in near-shore, shallow water was 1 o/oo more saline than offshore, deeper water, as a result of evaporation. (Cassar-FRC)
W82-02878

FINE STRUCTURE OF SALINITY IN THE WATER OFF THE DANUBE ESTUARY,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
V. I. timoshchuk, and N. S. Risik.
Hydrobiological Journal, Vol 16, No 4, p 80-85, 1980. 7 Fig, 7 Ref.

Descriptors: *Salinity, *Estuaries, *Danube estuary, Chemical properties, Salinity currents, Water currents, Water quality, Rivers, Europe.

The object of the study was to establish the fine structure of salinity in the sea area off the Danube estuary and to determine its principal variables. Water temperature and salinity were determined at depths of 0.5, 7, 10, and 15 meters, and currents were recorded at depths of 0, 5, and 10 meters. At the start of the observation period a 2-layered current was recorded. The surface current, the velocity of which was 5-20 cm/sec, coincided with the direction of the wind, but its direction was reversed in the thermohalocline (5-7 meters), where its velocity was 5-20 cm/sec. A current of compensational origin, the velocity of which varied between 5 and 13 cm/sec, was noted in the benthopelagic zone. When wind direction changed, the change was accompanied by an appreciable reconstruction of the currents in a definite sequence. Upon comparing the vertical profiles of salinity obtained by gradient water bottle and by standard procedures the values were found to coincide at depths of 0.5, 10, and 15 meters. The action of the wind on the surface of the water caused a current coinciding in direction with the wind and induced a counterflow in the pycnocline. Movement of the water toward the wind also develops immediately beneath the pycnocline. The study concluded that the main fine structure elements in the sea in front of the Danube are distinguishable on vertical salinity profiles from gradient water bottle data. The formation and variability of vertical structural heterogeneities is connected with the effect of the wind. There is a statistically significant reduction in the effect of the variability of structural heterogeneities between the surface and the bottom. (Baker-FRC)
W82-02892

THE VARIATION IN SUSPENDED SEDIMENT AND WATER PROPERTIES IN THE FLOOD-WATER FRONT TRAVERSING THE TIDAL FLAT,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
F. E. Anderson.
Estuaries, Vol 3, No 1, p 28-37, March, 1980. 9 Fig, 2 Tab, 41 Ref.

Descriptors: *Tidal flats, *Floods, Sedimentation, *New Hampshire, *Sediment transport, Physicochemical properties, Water properties, Temperature effects, Salinity, Chemical analysis, Chemical properties, Suspended sediments, Estuarine environment.

The changes in water and sediment properties were examined in an estuarine environment with progressive flooding of the intertidal zone. Day-to-day changes in water temperatures, salinities, and particulate matter concentrations were examined, and changes in sediment concentrations occurring across the tidal flat during flooding were examined. The study site was a tidal flat adjacent to the Jackson Estuarine Laboratory of the University of New Hampshire. The study revealed that heat was gained or lost from the flood front during its passage across the tidal flat, depending on the time of flooding as well as on insolation. While water temperature changes were great across the middle and upper intertidal zones, there was little relationship between water temperature and the particulate matter concentration. Salinities increased from the middle to upper intertidal zones in the flood front, regardless of sampling time or insolation. The particulate matter concentration appeared related to the interaction of small ripples with varying bottom slopes in the intertidal zone. The amount of particulate matter between stations was extremely variable and appeared related to coarser sediment alternately being resuspended and settling during flooding. The size of the particulate matter appeared coarser in the upper intertidal zone, where the bottom slopes were steeper and wave resuspension was more effective. (Baker-FRC)
W82-02928

CARBON DIOXIDE ASSIMILATION, PHOTOSYNTHETIC EFFICIENCY, AND RESPIRATION OF A CHESAPEAKE BAY SALT MARSH,
Smithsonian Institution, Rockville, MD. Radiation Biology Lab.
B. G. Drake, and M. Read.
Journal of Ecology, Vol 69, No 2, p 405-423, July, 1981. 9 Fig, 2 Tab, 44 Ref.

Descriptors: *Salt marshes, *Assimilative capacity, *Carbon dioxide, Diurnal distribution, Mathematical models, Photosynthesis, Respiration, *Chesapeake Bay, Estuarine environment.

The difference between net community CO2 accumulated during the day and the amount lost at night were determined for two Chesapeake Bay salt marshes during a typical season. A model for net community CO2 assimilation was constructed, based on the seasonal patterns of solar radiation, community photosynthetic efficiency, and respiration. The maximum value for day-time net CO2 assimilation per unit area of salt marsh between sunrise and sunset was 0.95 mol/m in June. Net CO2 assimilation by both communities during the summer accounted for 3.5 plus or minus 0.9% of the incident photosynthetically active radiation. The model estimated total CO2 assimilation for the entire growing season to be 62 mol/sq m. Photosynthetic efficiency from June to August was 1.9% but the net ecosystem efficiency was 0.8%, equivalent to 0.4% of total solar radiation. (Small-FRC)
W82-02937

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SEA WATER DISTILLATION IN JERSEY AND ITS USE TO AUGMENT CONVENTIONAL WATER RESOURCES,

Group 3A—Saline Water Conversion

Jersey New Waterworks Co. (England).
J. M. Hobbs.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 2, p 115-128, March, 1980. 8 Fig, 3 Tab.

Descriptors: *Seawater, *Water supply, *Water treatment, *Desalination, *Distillation, Coastal waters, Distilled water, Reservoirs, Boreholes, Long-term planning, Management planning, Projections, Technology, Design criteria, Cost analysis, Urban planning.

The factors that led to the building of a 6.8 million liter per day distillation plant in Jersey in 1969 are outlined. Operational problems and the costs of the plant and the water produced are discussed. Construction of a desalination plant was in response to projected water demands and to the popularity of desalination procedures in 1965, when the plant was first proposed. Operational problems have been relatively routine. The evaporator has scaling and corrosion problems. Abrasion of the pump impellers, jamming of motor seals in the sea water intake, and difficulties with feed water pumps are among the most significant problems. The largest expense is for fuel oil, the price of which has increased sharply due to international decisions. Unless there are substantial environmental considerations to take into account, less expensive means of storing surplus winter rain would be preferable to desalination. (Titus-FRC)
W82-02748

SCANNING ELECTRON MICROSCOPY STUDY ON REVERSE OSMOSIS MEMBRANES PREPARED FROM INDIAN CELLULOSIC POLYMERS,
Water Pollution Control Board, Baroda (India). Gujarat Regional Lab.
R. N. Kapadia, and V. P. Pandya.
Desalination, Vol 34, p 199-215, 1980. 12 Fig, 2 Tab, 9 Ref.

Descriptors: *Reverse osmosis, *Membrane processes, Membrane filters, *Cellulose acetate membranes, Desalination.

Indigenous cellulosic polymers were used to prepare five different reverse osmosis (RO) membranes under optimized conditions. The casting solutions were prepared by dissolving the polymer in a known quantity of the solvent and subsequently adding swelling agents in specific proportions. The entire mass was mixed to prevent acetone from escaping. Casting solutions were pressure filtered to remove undissolved particles and fibers. Membranes were cast in a flat sheet. In cross sectional studies, membranes were fixed vertically; for top surface studies, membranes were fixed horizontally on the sample holder. They were then immpersed in liquid nitrogen and coated with an Au-Pd alloy by evaporation under vacuum. Silver paint was applied to ensure that the specimen was at ground potential. The membranes prepared were cellulose diacetate, cellulose triacetate, cellulose indigenous acetate blend, cellulose di-tri acetate blend, and cellulose diacetate-polymethyl methacrylate blended membranes. Studies of the morphology and performance suggest that optimization conditions should be established so that the scanning micrograph shows a uniform top layer and the cross section shows a thin dense layer. The layer below the dense layer should have graded layers communicating with a large number of pores of inter-cellulose triacetate, either separately or blended in the component system, may lead to RO membranes showing product water flux above 10 fgd and solute rejection above 92%. (Baker-FRC)
W82-02929

3C. Use Of Water Of Impaired Quality

ESTIMATION OF PRIMARY PRODUCTIVITY FROM DIEL NITRATE UPTAKE MEASUREMENTS OF THE WATER HYACINTH EICHHORNIA CRASSIPES IN AN AQUACULTURE SYSTEM,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5D.
W82-02635

SELECTION OF IRRIGATION SYSTEMS FOR LAND APPLICATION OF MUNICIPAL WASTEWATER,
Williams and Works, Grand Rapids, MI.
J. C. Sutherland, and E. A. Myers.
Public Works, Vol 112, No 10, p 69-72, 91-92, October, 1981. 3 Fig.

Descriptors: *Wastewater irrigation, *Soil types, *Drainage, *Agriculture, Water table, Groundwater, Discharge, Watersheds, Flow, Seasonal variation, Sprinkler irrigation, Surface irrigation, Irrigation design, Land disposal, Land management, Water reuse, Land application, Municipal wastewater, Impaired water use.

Criteria for the selection of irrigation systems for land application of municipal wastewater are discussed. The major considerations are land costs, climate, and soil and groundwater characteristics. Soil texture must be evaluated along with the expected management practices and types of crop production. Groundwater quality, depth and direction of flow must be considered, in addition to potential seasonal fluctuations and the potential for manipulation. Three general irrigation processes are described. Rapid infiltration, slow-rate infiltration, and overland flow differ in their annual application amounts, averaging 80, 6, and 10 feet, respectively, where wastewater is applied for 6 months of the year. (Titus-FRC)
W82-02643

PP AND L USES DISCHARGE WATER FOR FISH FARMING.
Power Engineering, Vol 85, No 10, p 96, October, 1981. 1 Fig.

Descriptors: *Aquaculture, *Fish, *Powerplants, Water reuse, Heated water, Wastewater, Wastewater disposal, *Fish farming, *Catfish, Pennsylvania.

An aquaculture plant is being opened by Pennsylvania Power and Light Co. at its Brunner Island powerplant along the Susquehanna River south of Harrisburg. Catfish are being grown in an atmosphere enhanced by the warm water discharging from the plant. The commercial success of the project can be realized in two ways. First, a good use has been found for the waste heat from the powerplant. Second, a good source of food energy has been found at low cost. Under normal conditions in that area catfish may grow to about one pound in two to three years. Under the enhanced warmth, this same size can be attained in 32 to 36 weeks. The water is maintained between 80 and 85 degrees F, a temperature at which catfish thrive. By the time the project is completed, it is estimated that 500,000 lb of fish can be produced in a year. It is felt that the catfish may be used by the fast food chains now serving increasing amounts of fish. Other species than catfish may also be attempted. (Baker-FRC)
W82-02645

LAND APPLICATION OF WASTEWATERS: AN OVERVIEW.
D. B. Aulenbach.
Clearwaters, Vol 10, No 1, p 9-10, March, 1980.

Descriptors: *Wastewater disposal, *Land disposal, *Wastewater irrigation, Spray irrigation, Heavy metals, Overland flow, Infiltration.

The use of wastewaters for irrigation and fertilization of growing crops was practiced at least 400 years ago. At present, the concept of land application of wastewater takes on three major ideas: spray techniques used for irrigation, overland flow used for both crop production and wastewater renovation, and rapid infiltration used for treatment and recharge of groundwater. In spray irrigation the basic principle is to provide just enough liquid to support the roots of the crops to be grown and gain some fertilizer value from the wastewaters applied. Chlorination is recommended for any wastewaters applied to a food crop that is consumed without cooking. The overflow technique involves applying a thin sheet of water over a gently sloping field. The liquid flows over the surface of the ground, providing moisture to the roots and using the stem as a surface for attachment of bacteria that will consume the organic material in the applied wastewater. The rapid infiltration technique requires the use of relatively coarse soil or sands for the disposal system. A basin is carved into a sandy soil to above 1 meter depth. Wastewater is applied to a depth of 0.3 to 0.7 meters and the liquid allowed to infiltrate the soil, followed by about one day's drying prior to the next application. In general these treatments are inexpensive. The uptake of undesirable materials by the plants may be overcome by growing a non-edible crop such as trees or grass. (Baker-FRC)
W82-02650

WATER RECLAMATION BY THE USE OF SOIL-TURFGRASS SYSTEMS IN THE SOUTHWEST USA,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
I. L. Pepper, W. R. Kneebone, and P. R. Ludovici.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168626, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, 1981. 49 p, 40 Tab, 9 Ref. OWRT-B-072-ARIZ(1), 14-34-0001-9106.

Descriptors: *Reclaimed water, *Secondary wastewater treatment, *Groundwater recharge, *Land disposal, *Turfgrasses, Filtration soil-water-plant relationships, Water pollution control, Water reuse.

Application of wastewater to a soil-turf filter in excess of consumptive use allows reclamation of wastewater in the form of leachate into ground waters. This study investigated the maximum rates of effluent which could be applied to soil-turf filters without harming turfgrass or water quality of leachate. Recharge increased with rates of application and decreasing clay content of soil. Overall recharge was affected little by the type of grass grown as long as the grass was actively growing. Recharge was at a maximum in the winter and a minimum in the summer. Linear regression equations relating recharge to effluent loading rates were developed allowing prediction of recharge for a given rate with a given clay content. Nitrate nitrogen leachate concentrations are likely to be the limiting factor in determining the maximum loading rate for any given filter. Nitrate values increased with increased rate of application and decreased clay content. Values peaked during the cold months of December, January and February, and the hot summer months of June and July. Linear regression equations for each soil, and for different seasons were developed. These equations allow prediction of the maximum effluent loading rate which can be applied and still keep leachate NO3-N concentration less than 10 ppm. Boron, P and Na, Ca and Mg values of leachate were low, and not hazardous to water quality or turfgrass. Both virus particles and coliform bacteria were effectively removed by all soil filters listed.
W82-02817

3E. Conservation In Industry

COMBINED FLUE GAS DESULFURIZATION AND WATER TREATMENT IN COAL-FIRED POWER PLANTS,
Environmental Protection Agency, Research Triangle Park, NC. Utilities and Industrial Power Div.
R. H. Borgwardt.
Environmental Science and Technology, Vol 14, No 3, p 294-298, March, 1980. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Water reuse, *Powerplants, *Cooling water, *Wastewater treatment, Water treatment, Water conservation, Air pollution, Coal, Fuel, Boiler water, Industrial water, Water pollution control, Sulfur, Electric powerplants.

An improvement in powerplant water reuse efficiency and a reduction in the uncontrolled discharge of soluble salts and trace elements were attained by adding sodium sulfate to the flue gas desulfurization (FGD) limestone scrubbers and including a water treatment unit such as the vapor compression evaporator. It was possible to replace all the makeup water with cooling water blowdown containing up to 690 ppm Na+ (for low-sulfur coal) when operating under appropriate conditions (less than 2500 ppm SO2 in flue gas at a Na+ level of 15,000 ppm in the scrubbing liquor or 3000 ppm SO2 and 8000 ppm Na+). By integrating the water treatment system into the FGD, rather than into the cooling water blowdown stream, water recovery was increased 50% because the FGD scrubber preconcentrates the blowdown prior to water treatment. In addition, the evaporator produces high-quality condensate usable as boiler makeup water. (Cassar-FRC)
W82-02606

3F. Conservation In Agriculture

PLANTING DATE AND WATER DEFICIT EFFECTS ON DEVELOPMENT AND YIELD OF IRRIGATED WINTER WHEAT,
Southwestern Great Plains Research Center, Bushland, TX.
J. T. Musick, and D. A. Dusek.
Agronomy Journal, Vol 72, p 45-52, January/February, 1980. 6 Fig, 2 Tab, 14 Ref.

Descriptors: *Water stress, *Wheat, *Irrigation effects, Crop yield, Grain crops, Water deficit, Plant growth.

Three planting dates (Sept. 15, early; Oct. 12, normal; and Nov. 7, late) and 4 to 6 water deficit treatments were evaluated with 2 short winter wheats, TAM W-101 and Vona. Early and normal planting as compared with late planting increased dry matter and grain yield and favored development at all stages: phenological level, vegetative period, blooming period, and tillering. Plant water deficits were selected to cause water stress at 1 or more of the following stages: leaf and tiller vegetative growth, spikelet differentiation to late bootheading, and flowering through grain filling. Plant water deficits reduced yields of wheat by increasing tiller and stem senescence and grain numbers. The yields of both varieties were similar, but Vona had smaller and more numerous grains. TAM W-101 was more resistant than Vona to severe desiccation and tiller stem senescence under severe water deficits. (Cassar-FRC)
W82-02607

RESPONSE FUNCTIONS OF CROPS YIELD TO SOIL MOISTURE STRESS,
Escuela Nacional de Agricultura, Chapingo (Mexico). Colegio de Postgraduados.
E. V. Palacios.
Water Resources Bulletin, Vol 17, No 4, p 699-703, August, 1981. 10 Ref.

Descriptors: *Soil moisture deficiency, *Crop yield, Estimating equations, Mathematical studies, Economic aspects, Plant growth, Available water, Irrigation, *Irrigation efficiency, Irrigation practices.

Efforts were made to define a methodology for determining an optimal irrigation policy to attain a maximum economic yield of crops or, in rain fed farming, to forecast the effect of various precipitation regimes on crop yield by means of a simulation model of the soil-plant-atmosphere system. The method is based on an empirical response function, relating crop yield to soil moisture stress in different stages of plant growth. The function was developed from data obtained during field experiments on several crops and may be useful in determining when and how much to irrigate. A mathematical expression was also derived from that function which estimates the economic loss if irrigation is not applied at the opportune moment. (Baker-FRC)
W82-02725

WATER MANAGEMENT IN THE NORTH DESCHUTES UNIT IRRIGATION DISTRICT: GEOGRAPHIC PERSPECTIVES AND REMOTE SENSING APPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geography.
For primary bibliographic entry see Field 7B.
W82-02739

INFLUENCE OF IRRIGATION RHYTHM AND WATER SUPPLY ON GROWTH, WATER STATUS AND YIELD OF EGG-PLANT (SOLANUM MELONGENA L.),
Institut National de la Recherche Agronomique, Paris (France).
P. Cornillon, and P. Dauple.
Plant and soil, Vol 59, No 3, p 365-379, 1981. 6 Fig, 2 Tab, 11 Ref.

Descriptors: *Irrigation requirements, *Eggplants, *Crop yield, Evapotranspiration, Water use, Water requirements, Consumptive use, Trickle irrigation, Furrow irrigation, Plant growth, Soil-water-plant relationships, France.

Irrigation regimes were tested on two varieties of eggplant grown in France on St. Paul silt loam during 1975 and 1976. Best marketable fruit yield was produced by irrigation amounting to 80% of the potential evapotranspiration. Daily trickle irrigation produced better fruit yields than did biweekly furrow irrigation. The cultivar Violette de Barbentane produced 20% more fruit and used less water than Ronde de Valence. Violette, of tropical origin, responded better to trickle irrigation, and Ronde de Valence, a northern variety, responded better to furrow irrigation. (Cassar-FRC)
W82-02746

WATER LEVELS AND LOSSES AND CLEANING IN WATERCOURSES,
Pakistan Water and Power Development Authority, Lahore.
M. Akram, W. D. Kemper, and J. D. Sabey.
Transactions of the ASAE, Vol 24, No 3, p 643-650, May/June, 1981. 16 Fig, 1 Tab, 8 Ref.

Descriptors: *Water loss, *Irrigation ditches, *Vegetation effects, Revegetation, Cleaning, Water level, Hydraulic roughness, Water conservation.

The role of cleaning in reducing earthen watercourse water loss was explored. First, an operating level was determined for two waterways. The rate of flow in the watercourse was determined, and the water width was determined at 3 cm above operating level. The watercourses were cleaned by removing the grass from the sides and bottom of the channels along with a little sediment. After cleaning, the water level was determined with respect to the datum marks (3 cm above operating level before cleaning). Earthen watercourses are generally designed by assuming a roughness coefficient in Manning's equation of 0.04, and the roughness coefficient of a smooth earthen ditch is closer to 0.03. Thus, the water level in a clean watercourse will be a few centimeters lower than the designed level. Economically, the optimum time for cleaning will depend on the value of the water that will be saved, the cleaning cost, and the functional relation between loss rate and water surface level. Ponding and recession measurement of water loss are simple and economic ways to help determine the optimum schedule for cleaning. (Small-FRC)
W82-02747

MANAGEMENT OF SOIL WATER BUDGETS OF RECHARGE AREAS FOR CONTROL OF SALINITY IN SOUTH-WESTERN AUSTRALIA,
Western Australia Univ., Nedlands. Dept. of Agronomy.
R. H. Sedgley, R. E. Smith, and D. Tennant.
Agricultural Water Management, Vol 4, No 1/3, p 313-334, 1981. 4 Fig, 2 Tab, 35 Ref.

Descriptors: *Soil water, *Water conservation, *Salinity, Cropland, Water resources development, Farming, Cereal crops, Grain crops, Farm management, *Australia.

Theory relating to analysis and simulation of soil water budgets in recharge areas is outlined. Ways in which their components may be affected by the interaction between weather patterns and changes caused by clearing of the original deep-rooted flora are summarized. Limited local data from the cereal belt are presented to indicate the scope for minimizing recharge by agronomic approaches. Recharge is simulated as a function of rainfall patterns in a first step toward a systematic analysis of the control of salinization by management of recharge. The objective in controlling salinity by better management of recharge areas is to increase evapotranspiration. This largely involves increasing the duration and extent of plant cover. Management of water budgets in recharge areas involves two processes. First, recharge must be minimized below root zones of agricultural species by careful selection and cultivation of deeper-rooted agricultural types. Secondly, interception and extraction of recharge below the root zone of agricultural species must be carried out by strategic placement of deep-rooted indigenous or exotic tree species. Water budgets in recharge areas can be modified through better management of subterranean clover pastures, replacement of such pastures with a grain legume phase using lupins, or with cereal-legume mixtures. Better adapted and higher yielding wheat cultivars for closer rotations and the development of cereal cultivars and clover strains with root systems better able to extract water at depth will also help. (Baker-FRC)
W82-02754

RESOURCE ALLOCATION IN A SIERRA-NEVADA FOOTHILL BEEF COW-CALF OPERATION THROUGH LINEAR PROGRAMMING,
California Univ., Davis. Dept. of Agronomy and Range Sciences.
D. M. Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168543, Price codes: A11 in paper copy, A01 in microfiche. PhD Dissertation, March, 1981, 221 p, 14 Fig, 31 Tab, 3 Append. (California Water Resources Center Project UCAL-W-495). OWRT-B-175-CAL(9).

Descriptors: *Range management, *Cattle, *Ranges, *Grazing, Forages, Fodder, Economics, Model studies, Sensitivity analysis, Productivity.

Using a Sierra-Nevada foothill beef cow-calf operation as a case study, two methods of developing the production coefficients needed to develop a profit maximizing linear programming model were compared. One method, called the grazing record method, used existing grazing records and historical stocking rates as a data base for deriving production coefficients. The other method, called the forage production method, used estimates of seasonal forage production from the literature augmented by the results of a dynamic simulation model (ELMAGE) to derive needed production coefficients. In both models a cow-calf operation producing weaner calves was selected over purchased stocker steers or calcus held over and seed or yearlings. In the grazing record model none of the possible range improvements were chosen. Sensitivity analysis showed the optimal solution to be robust to both decreases in the price of various improvements and increases in cattle prices. The optimal solution of the forage production model included nitrogen fertilization of open rangeland and the purchase of alfalfa har or profitable sources of additional feed. Sensitivity analysis indicated that these two fed sources were economically interchangeable. But both models showed a shortage of feed in the inadequate green feed period to be limiting to beef production and ranch income. It was concluded that until a much larger data base is accumulated for seasonal forage production and nutrient requirements for cattle on range, the grazing record method is as illiminating to the ranch operator decision maker as the more demanding forage production model. (Snyder-California)
W82-02809

MULTIOBJECTIVE ANALYSIS OF IRRIGATION PLANNING IN RIVER BASIN DEVELOPMENT,

Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W82-02855

THE IRRIGATION SCHEDULING PROBLEM AND EVAPOTRANSPIRATION UNCERTAINTY,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 2D.
W82-02900

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

COMPUTERIZED CONTROL OF AN OPEN-CHANNEL WATER DISTRIBUTION SYSTEM,
Arizona State Univ., Tempe.
D. D. Zimbelman.
PhD Dissertation, May, 1981. 316 p, 55 Fig, 10 Tab, 44 Ref, 6 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-17192.

Descriptors: *Water distribution, *Open channel flow, *Algorithms, Water demand, Automation, Computers, Water control, Water level.

The objective of this research was to develop an algorithm for the computerized control of an open-channel water distribution system that would allow the system to be operated on a demand basis rather than on a scheduled basis. Downstream control introduces water into the system in direct proportion to the amount of water withdrawn. The input to the algorithm is the water surface upstream of each control structure. The output from the algorithm is an adjustment in gate opening to be implemented at the adjacent upstream control structure. The adequacy of the algorithm was verified by simulating the interaction between the algorithm and two different typical canal systems. On each canal, six cases representing automated control and four cases representing manual control were simulated. These simulations were used to first establish viability of the algorithm in an automated control environment, and secondly to compare automated control to manual. It is the conclusion of this research that the control algorithm is capable of controlling an open-channel water distribution system at a higher level of efficiency than manual control, where efficiency is measured in terms of the stability of the water surface elevations within the system. (Sinha-OEIS)
W82-02732

SUPPLEMENT TO PREDICTIVE MODELING OF EFFECTS OF THE PLANNED KINDRED LAKE ON GROUND-WATER LEVELS AND DISCHARGE, SOUTHEASTERN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $8.25 in paper copy, $6.00 in microfiche. Geological Survey Open-File Report 81-646, June 1981. 15 p, 1 Fig, 5 Plates, 39 Ref.

Descriptors: *Model studies, *Preimpoundment, *Reservoir sites, Dam construction, Planning, Forecasting, *Groundwater level, Groundwater movement, Aquifer characteristics, Surface groundwater relations, Water table, Hydraulic conductivity, Recharge, Evapotranspiration, Computer models, Water level fluctuations, *North Dakota, *Sheyenne River.

A digital model was used to describe a groundwater system in glacial deltaic deposits near Kindred, N.D., and to predict the effects on groundwater levels of a planned lake at the 950-, 960-, 970-, 984-, and 995-foot stages. Model analysis indicates that only the area within a radius of about 2 miles of the dam on the present Sheyenne River would be affected by rising water levels as a result of a lake stage at 995 feet. The rise of water levels depends on time and hydraulic properties of the aquifer. The maximum projected rise in water levels at the various stages should occur in about 50 to 100 years. Evapotranspiration and existing drains will be effective in limiting the extent of water-level rise. (USGS)
W82-02828

FLOW DURATION AT SELECTED STREAM-SITES IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W82-02837

TECHNICAL AND ECOLOGICAL IMPACTS OF THE HIGH ASWAN DAM,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
A-A. I. Kashef.
Journal of Hydrology, Vol 53, No 1-2, p 73-84, September, 1981. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Dams, *Environmental effects, *Erosion control, Weirs, *Nile River, *High Aswan Dam, *Irrigation effects, Water resources development, Ecological effects, Channel erosion, Beach erosion, Bank erosion, Silting, Reservoir silting, Human diseases, Fishing, Watershed management.

The High Aswan Dam was constructed in 1952 to provide for the irrigation demands of agricultural expansion, to generate electricity, to supplement the water supply during low-stage years and to protect the land from high floods. Channels from the reservoir downstream of the dam are to be used in a new irrigation project to feed the Western Desert areas. A proposed submerged weir could improve the performance of the channel by diverting lost silts back to Egypt. The diverted silts would lessen the need for chemical fertilizers, prevent erosion along the Nile and other waterways, and hinder the advance of the Mediterranean shoreline. Other environmental impacts that have been associated with the High Aswan Dam since its building include the deterioration of Mediterranean summer resorts due to beach erosion, the spread of water-borne diseases, the flooding of villages near the dam reservoir, and losses suffered by the fishing industry due to the lack of silting along salmonid spawning areas. (Geiger-FRC)
W82-02856

A SOLUTION TO SPRING ICE-JAM FLOODING,
For primary bibliographic entry see Field 2C.
W82-02908

REGIONALIZATION AND PREDICTION OF ANNUAL FLOODS IN THE FRASER RIVER CATCHMENT, BRITISH COLUMBIA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W82-02910

CLOSURE OF THE KAMA RIVER AT THE SITE OF THE LOWER KAMA HYDROELECTRIC PLANT,
For primary bibliographic entry see Field 8A.
W82-02951

4B. Groundwater Management

AN ECONOMIC ANALYSIS OF GROUND WATER MANAGEMENT ALTERNATIVES,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
D. A. D. Comer.
PhD Dissertation, 1981. 147 p, 11 Fig, 24 Tab, 37 Ref, Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-13280.

Descriptors: *Groundwater management, Groundwater storage, *Economic aspects, *Model studies, Groundwater mining, Water resources development, Income, Agriculture, Aquifers, *Nebraska, Upper Big Blue Natural Resources District.

Alternatives for managing existing ground water are similar for all areas facing ground water mining problems. The specific impact of an option will depend upon the specific hydrologic and soil characteristics of the area, the cropping patterns, and climatic conditions. These factors lend themselves well to a case study approach. Within Nebraska, there are several areas with ground water mining problems and one of these areas, the Upper Big Blue Natural resources District has been selected as the study area. Several options are examined to see how they impact on farm and regional income over time. The objectives were to evaluate the impacts of options on farm level income, on aggregate farm income and on the aquifer. The model was structured to determine how producers might respond to three-year allocations. A recursive, polyperiod linear program formed the basis of the farmer's decisions. The polyperiod component was necessary to reflect the opportunity cost of using water in year one rather than year two or three. It was recursive to allow for reflection of the impact of action in earlier years on costs in subsequent years. Producers were assumed to plan based on average values but could adjust their intentions according to the weather conditions. A 400-node, three dimensional finite element hydrologic ground water model was used to simulate the impact of annual pumpage on the aquifer. New pump costs were estimated annually to reflect changing aquifer conditions. (Sinha-OEIS)
W82-02740

WATER RECLAMATION BY THE USE OF SOIL-TURFGRASS SYSTEMS IN THE SOUTHWEST USA,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 3C.
W82-02817

MANAGING CRISIS: THE EFFECTIVENESS OF LOCAL DISTRICTS FOR CONTROL OF GROUND WATER MINING,
Colorado Univ., Denver. Graduate School of Public Affairs.
L. F. Keller, C. G. Heatwole, and J. W. Weber.
Water Resources Bulletin, Vol 17, No 4, p 647-654, August, 1981. 8 Fig, 3 Tab, 10 Ref. OWRT-B-046-KAN(3).

Descriptors: *Groundwater mining, Management, Decision making, Water supply development, Water management, *Groundwater management, Water supply, Available water, Design criteria, *Ogallala Aquifer, Legal aspects, Public opinion, Political aspects, Surveys.

The willingness and ability of local districts to control groundwater mining of the Ogallala Aquifer in the High Plains has been studied. A survey was conducted among district officials, irrigators, and citizens. While the assessment is preliminary in nature, it is possible to highlight critical issues concerning effectiveness of districts in dealing with the problem. Most of the states experiencing groundwater mining are using local groundwater districts or more broadly based Natural Resource Districts. Though the exact authority granted to districts varies, their importance as the policy focus for dealing with groundwater mining will probably continue to expand. Districts do appear to have potential effectiveness. A local consensus has developed that ground water mining problems are serious, and that controls such as metering and well spacing are needed. District officials appear to have some expertise in the area and are dedicated to service to the local community. However, there does not appear to be a similar feeling of agreement regarding additional regulatory policies. Most of those surveyed appear willing to change

some behavior, but there does not seem to be much interest in going beyond the minimum change. It may be difficult to mobilize popular support for regulatory policies, as district officials oppose regulation more strongly than does the general population. In New Mexico, however, more extensively planned and regulated use of groundwater is taking place. In this area the management district becomes more of a service agency, maintaining meters and brokering marketable permits, rather than conducting research or making basic policy. (Baker-FRC)
W82-02819

METHOD OF CONSTRUCTING A SYSTEM FOR CONTROLLING REGIONAL EXPLOITABLE GROUNDWATER RESOURCES,
Moscow State Univ. (USSR).
V. S. Zil'berg, and M. S. Krass.
Water Resources (English Translation), Vol 7, No 6, p 536-545, November/December, 1980. 8 Ref. Translated from Vodnye Resursy, No 6, p 108-119, November-December, 1980.

Descriptors: *Groundwater management, *Control systems, *Linear programming, Computers, Computer models, Groundwater availability.

A control system for regional exploitable groundwater resources is an algorithm which should provide for determination of the capacity of any number of operating and planned intakes arbitrarily arranged within the investigated territory. It will deal with three things: initial information, prediction of the capacity of oriented intakes, and optimization of the number of intakes, their capacity, and location. Problems can be formulated and reduced to linear programming. They can be solved using computers. High speed computers can solve the problems quickly; this facilitates the optimization of the number of intakes, their capacity, and location within a large region. In the future, real time programming can be used in control systems. (Small-FRC)
W82-02849

EFFECT OF IRRIGATION ON GROUNDWATER RESOURCES WITH SPECIAL REFERENCE TO THE VAKHSH VALLEY,
All-Union Scientific-Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 2A.
W82-02851

SCIENTIFIC AND TECHNICAL ASPECTS OF THE RATIONAL USE AND CONSERVATION OF GROUNDWATERS IN THE UKRAINIAN SSR,
Ministerstvo Geologii, Moscow (USSR).
N. I. Beseda, and P. I. Yakovenko.
Water Resources (English Translation), Vol 7, No 6, p 528-536, November-December, 1980. 5 Tab, 7 Ref. Translated from Vodnye Resursy, No 6, p 97-107, November-December, 1980.

Descriptors: *Groundwater management, *Water conservation, *Groundwater potential, Water management, Groundwater depletion, Ukrainian SSR.

Management of groundwater resources in the Ukrainian SSR was investigated because about 23% of the resource has been used in each of recent years. The first step is the estimation of exploitable groundwater supplies, which requires a regional study and the quantitative evaluation of exchange between ground and surface waters. A survey of the Ukrainian SSR indicated that about 50% of all resources are confined to the Dnepr-Donets artesian basin, and about 24% are concentrated in the Volyn-Podolia basin. Current groundwater withdrawals amount to about 12.9 million cu m/day. Groundwater resources in 30% of the Ukraine are insufficient to meet future needs, but when the Ukraine is looked at as a whole, if use of surface water is reduced in the northern regions, there should be sufficient groundwater in the southern regions. Suggestions are presented for promoting rational use and conservation measures in the arrea. (Small-FRC)
W82-02852

AQUIFER THERMAL ENERGY STORAGE: A NUMERICAL SIMULATION OF AUBURN UNIVERSITY FIELD EXPERIMENTS,
California Univ., Berkeley. Lawrence Berkeley Lab.
C. F. Tsang, T. Buscheck, and C. Doughty.
Water Resources Research, Vol 17, No 3, p 647-658, June, 1981. 20 Fig, 5 Tab, 36 Ref.

Descriptors: *Aquifer management, *Energy storage, Geothermal studies, Computer models, Model studies, Groundwater management, *Thermal water, Wells, *Injection wells, Water storage, Auburn University, Confined aquifers.

A computer simulation of two 6-month cycles of injection-storage-production of hot water in confined aquifers, the Auburn University Thermal Energy Storage Project, agreed very well with field data. The first cycle involved the injection and recovery of about 55,000 cu m of water, heated to an average of 55.2 degrees C, in 79 days. The warm water was stored for 52 days, then pumped out until the recovered water temperature fell to 32.8 degrees C. By that time, 66% of the water had been recovered. The second cycle was similar, although somewhat more prolonged, and 76% of the energy injected was recoverd. Although there were discrepancies between calculated and experimental data in the detailed temperature distribution comparisons, some cancelled themselves during the injection-production process, so that final prdduction temperatures were very well simulated. (Cassar-FRC)
W82-02919

INJECTION, RECHARGE AND RETURN WELLS,
T. Gass.
Water Well Journal, Vol 35, No 10, p 36-37, October, 1981.

Descriptors: *Wells, *Groundwater management, Injection wells, Recharge wells, Return wells, Water pollution sources, *Groundwater recharge, Groundwater contamination, Aquifer management.

Definitions are proposed for three types of wells (injection, recharge, and return) in order to alleviate the confusion caused by interchangeable use of these terms. An injection well is a well into which water, gas, or liquid waste is injected under pressure or gravity flow to dispose of wastes and/or maintain formation pressures. These wells pose the highest risk to the environment. A recharge well is a well into which water is allowed to flow by gravity or injected under pressure for the purpose of aquifer management. The recharge water must be of sufficient quality so that the groundwater quality is not degraded. A return well is a well into which water that was previously withdrawn for heating or cooling purposes is returned to the same aquifer. Water quality of return water should be comparable to that of the water originally drawn. (Cassar-FRC)
W82-02920

4C. Effects On Water Of Man's Non-Water Activities

THE EFFECTS OF URBANIZATION ON SMALL WATERSHEDS AND GROUNDWATER,
Rochester Univ., NY. Dept. of Geological Sciences.
For primary bibliographic entry see Field 5C.
W82-02738

THE INFLUENCE OF STREAM SALINITY ON RESERVOIR WATER QUALITY,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
J. Imberger.
Agricultural Water Management, Vol 4, No 1/3, p 255-273, 1981. 9 Fig, 1 Tab, 19 Ref.

Descriptors: *Salinity, *Reservoirs, Lakes, Water quality, *Australia, Land management, Water supply, Water pollution sources, Catchments, Solute transport, Model studies, Land use, *Saline water intrusion.

The salt content of the Wellington Reservoir is examined as it may relate to the increased salinity of drylands in Western Australia. During periods of rain, the perched aquifer builds up, causing leaching of the salt accumulated by direct water ponding during the end of the previous winter and that accumulated by the upward percolation. In areas of saturation of the perched aquifer, direct runoff will occur, leading to a very rapid response of the streams. The salt stored on the surface and in the perched aquifer will be flushed out once the water has travelled a distance characterized by the width of the contributing area. Deep-rooted vegetation may prevent the buildup of the upward flows into the contributing areas and may also drain much of the perched aquifer during the winter months. The dynamic reservoir simulation model, DYRSEM, is a one-dimensional numerical simulation model for the prediction of temperature and salinity in small to medium lakes. It is based on the assumption that in such lakes the thermal structure plays a dominant role, and the isotherms are mostly horizontal planes. These assumptions place some restrictions on the applicability of the model. The major evaluation of the model was made using the Wellington Reservoir. An examination of the salinity variations in the Collie River revealed a structure dependent on the peak and base flow salinity, the phase during storms and the flushing time of the whole system. This variation was used to modify an existing salinity record to simulate possible future trends. The exact nature of salinity variations is not the most significant prediction, but the mixing in the reservoir which acts as a strong filter is important. Without drastic action, the salinity in the Wellington reservoir will become excessive in the near future. A by-pass strategy is suggested. (Baker-FRC)
W82-02762

URBAN CATCHMENT MODELS: A BRIEF EXAMINATION,
George Washington Univ., Washington, DC.
F. O. Agyei, K. Mahmood, and M. I. Haque.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168584, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Report No 28, May, 1981. 34 p, 3 Fig, 3 Tab, 43 Ref. OWRT-A-008-DC(1), 14-34-001-0109.

Descriptors: *Computer models, *Hydrologic models, Hydrology, Hydrographs, *Urban runoff, Drainage basins, Runoff, Routing, Streamflow routing, Flood routing, *Storm runoff, Urban watersheds.

Guidelines for the use of various commonly available urban catchment models are provided. The models described in this report include (1) Chicago Hydrologic Model, (2) Road Research Laboratory Model, (3) University of Cincinnati Urban Runoff Model, and (4) University of Florida's Storm Water Management Model. Only the salient features of these models are described and no attempt is made to provide a comprehensive comparison between these models. Nevertheless, capabilities and limitations of each model are described to aid the potential user in making the proper choice.
W82-02813

4D. Watershed Protection

MODELING RILL DENSITY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W82-02604

ROLE OF ORGANIC DEBRIS DAMS IN REGULATING THE EXPORT OF DISSOLVED AND PARTICULATE MATTER FROM A FORESTED WATERSHED,

Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. E. Bilby.
Ecology, Vol 62, No 5, p 1234-1243, October, 1981. 5 Fig, 5 Tab, 31 Ref.

Descriptors: *Streamflow, *Detritus, *Dams, Particulate matter, Runoff, Erosion, *Forest watersheds.

This experiment was designed to quantify the effect of organic debris dams on the export of materials from a small forested watershed ecosystem. All debris dams were removed from a 175-m section of a second-order stream. just above a gauging weir. The material being exported from the watershed was collected for one year before dam removal and for one year following removal. Export of dissolved material increased slightly following dam removal, while fine particulate matter export increased dramatically at high discharges. Coarse particulate matter export was also increased. Dam removal brought about a 6% increase in the export of dissolved matter and a 500% increase in the export of fine and coarse particulate matter. (Small-FRC)
W82-02653

THE EVOLUTION OF A REGIONAL APPROACH TO SALINITY MANAGEMENT IN WESTERN AUSTRALIA,
Perth Public Works Dept. (Australia).
B. S. Sadler, and P. J. Williams.
Agricultural Water Management, Vol 4, No 1/3, p 353-381, 1981. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Salinity, *Water resources development, Water management, *Australia, Land use, Groundwater management, River basins, Catchment areas, Revegetation, Reforestation, Vegetation establishment, *Water pollution control, Saline water intrusion, Saline diversions.

Efforts to contain and minimize the risk of increasing areas of dryland salinity in Western Australia are needed. To define the regional variations of the problem, south-west Australia has been divided into four zones: the coastal zone between the coast and the Darling Scarp, the high rainfall zone from the scarpeastwards to the 1100 mm rainfall isohyet, the intermediate zone with about 1100 to 900 mm of rainfall, and the low rainfall zone inland from the 900 mm isohyet. In this fourth zone salt storage is high and clearing almost invariably causes salt release. The third zone has highly variable potentials for salt release. Management strategies to control the release of salts include the prevention or limitation of clearing of the land and the restoration or amelioration of areas already cleared. Adaptation of land and water use is viewed as one means of adapting to the release of salts. Another method of adaptation may be abandonment of seeps through substitution of developed sources for alternatives. Salt disposal, reservoir management, seasonal withdrawals, saline diversions and desalination are possible means of adjusting to the release of salts by salt disposal. Dilution of salts can be obtained by blending fresh and brackish water, or by increasing runoff in salt free areas. Salt tolerant vegetation can be planted in efforts to cope with the situation. While partial reforestation, deep-rooted vegetation and deep drainage have all been proposed as possible control measures, none has yet been developed to provide economical control of salt seeps. (Baker-FRC)
W82-02763

MAPPING SEDIMENT SOURCES IN A NEW ZEALAND MOUNTAIN WATERSHED,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 2J.
W82-02885

EROSION CONTROL ALONG TRANSPORTATION ROUTES IN NORTHERN CLIMATES,
Komex Consultants, Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 2J.
W82-02933

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

RAINWATER ACIDITY MEASUREMENT PROBLEMS,
William and Mary Coll., Williamsburg, VA. Dept. of Chemistry.
S. Y. Tyree, Jr.
Atmospheric Environment, Vol 5, No 1, p 57-60, January, 1981. 1 Fig, 5 Tab, 19 Ref.

Descriptors: *Acid rain, *Measuring instruments, Chemical analysis, Water analysis, Rainfall, Acidity, Air pollution, Water pollution sources, Titration.

Three methods which are currently used to determine the acidity of rainwater have been studied. The first method relies on pH measurement, the second on titration, and the third assumes that any charge discrepancy in favor of anions is due to hydronium ion concentration. In this third method only strong acid is measured, and the method is used only for those solutions at or below a pH value of 5.6. The method requires the determination of concentrations of all principal ions in the rainwater sample, usually considered to be chloride, nitrate, sulfate, ammonium, sodium, potassium, calcium, and magnesium. The accuracy and reproducibility of such a method are no better than the properly combined accuracy and reproducibility of each of the principal solute ion values. The first method, the pH measurement, measures the concentration of strong acids plus some of the weak acids in rainwater. However, the accuracy and reproducibility are not sufficient. Similarly, the accuracy and reproducibility of the titration method are also unacceptable. The results of two collaborative intercomparison laboratory studies on simulated rainwater show that adequate analytical reproducibility is not being attained at present. (Baker-FRC)
W82-02627

ON THE VAN BELLE-FISHER STATISTIC FOR WATER POLLUTION MONITORING VIA ECOLOGICAL CHANGE,
Washington Univ., Seattle.
E. P. Smith, and L. L. Conquest.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1648-1650, November, 1981. 2 Fig, 3 Tab, 2 Ref.

Descriptors: *Statistical analysis, *Water pollution effects, Population dynamics, Monitoring, Ecological effects, Mathematical studies, Water pollution.

The van Belle-Fisher statistic indicates only changes in the rank of species count and not the direction of change. When used for water pollution monitoring via ecological change a modified test statistic indicating increases in abundance of pollution tolerant species and decreases in pollution-sensitive ones would be useful. The interpretation of the results of van Belle and Fisher's application of the test statistic to Green Bay is questioned, and mistakes in computations are detailed. (Small-FRC)
W82-02671

TO INHIBIT OR NOT TO INHIBIT: THAT IS THE QUESTION,
E. F. Barth.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1651-1652, November, 1981.

Descriptors: *Biochemical oxygen demand, *Water analysis, *Nitrification, Ammonium nitrogen, Water quality, Water quality standards, Evaluation.

The Federal discharge standard for BOD5 content may not be achieved if ammonium nitrogen in the sample is biologically oxidized to nitrite or nitrate nitrogen. Techniques to inhibit this reaction and allow the BOD5 test to respond only to carbonaceous material are available, and the extent of this nitrification reaction is erratic and nonpredictable under conditions of the standard test. Regulatory agencies should endorse the inhibited BOD5 test to more accurately reflect carbonaceous removal efficiency in regard to municipal compliance with secondary treatment standards. The inhibited BOD5 test can be supplemented with a separate determination of total Kjeldahl nitrogen. (Small-FRC)
W82-02672

CONCENTRATION OF VIRUS FROM TAP WATER AT AMBIENT SALT AND PH LEVELS USING POSITIVELY CHARGED FILTER MEDIA,
University Coll., London (England). Dept. of Civil Engineering.
H. Garelick, and J. E. Scutt.
Water Research, Vol 15, No 7, p 815-816, July, 1981. 2 Tab, 18 Ref.

Descriptors: *Viruses, *Filter media, *Asbestos, *Pollutant identification, Water analysis, Water purification, Adsorption.

Positively charged asbestos filters (Carlson-Ford type 4) were investigated for the detection of coliphage f2 and poliovirus 1 from tap water at low concentrations. The adsorption was performed at ambient pH 7.8, without addition of multivalent cations. Water samples inoculated with stock virus were pressure filtered. Adsorbed viruses were eluted by passing through the filter three sucessive 25 ml volumes of concentrated nutrient broth. Eluates were neutralized with glycine and assayed individually for virus. Average recoveries of coliphage f2 from 50 ml and 20 liter volumes were 64 and 65% respectively; the average recovery of poliovirus 1 in 20 liter volume was 68%. The large variability of coliphage results may have been due to virus aggregation or disaggregation in the course of the experiments. Other nominally positive media including alumina fibers and glass fibers coated with cationic polymers were also investigated for phase recovering ability, but were much less efficient than asbestos. (Cassar-FRC)
W82-02712

APPLICATION OF HYDRIDE GENERATION TO THE DETERMINATION OF TRACE CONCENTRATIONS OF ARSENIC BY INDUCTIVELY-COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY,
Osaka Prefecture Univ. (Japan). Dept. of Applied Chemistry.
T. Nakahara.
Analytica Chimica Acta, Vol 131, p 73-82, 1981. 3 Fig, 5 Tab, 34 Ref.

Descriptors: *Arsenic, *Detection limits, *Water analysis, Wastewater treatment, Water pollution control, Emission spectroscopy.

A proposed method for the determination of traces of arsenic was applied to the determination of ng/ml levels of arsenic in wastewaters. The detection method is based on sodium tetrahydroborate reduction of arsenic, followed by introduction of the arsine formed to a relatively low-powered inductively-coupled plasma. The method was applied to water samples collected at the inlet of the Wastewater Treatment Facility, University of Osaka Prefecture. Results indicated good agreement between the proposed method and hydride-generation-non-dispersive atomic fluorescence spectrometry. Thus, the sensitivity of the method is adequate for the determination of arsenic in wastewater. The method has a detection limit of 0.1 ng As/ml and the linear calibration range spans almost four orders of magnitude. (Small-FRC)
W82-02718

VOLATILE ORGANIC ACIDS IN LAKE WATER; THEIR GAS CHROMATOGRAPHIC DETERMINATION AND ECOLOGICAL SIGNIFICANCE,
Nagoya Univ. (Japan). Water Research Inst.
T. Hama, and N. Handa.

Japanese Journal of Limnology, Vol 42, No 1, p 8-19, January, 1981. 9 Fig, 2 Tab, 27 Ref.

Descriptors: *Lakes, *Volatile acids, Organic compounds, Water analysis, Chemical analysis, Chromatography, Organic acids, *Pollutant identification.

A study was conducted in an attempt to establish analytical procedures for volatile organic acids by gas chromatography after conversion of the acids to corresponding benzyl esters on the basis of the method developed by Bethge and Lindstrom, to apply this procedure to the analysis of volatile organic acids dissolved in lake water, and to understand the significance of volatile organic acids in terms of the dynamics of organic matter in lake water. Using this method only 50-250 ml of lake water was needed for determination of the volatile organic acids. The identification of benzyl esters was conducted by combined gas chromatography-mass spectrometry. Acetic, propionic, n-butyric and lactic acids were found in the water samples from Lake Kizaki. However, formic acid was identified only by the retention time in gas chromatography. Formic, acetic and propionic acids measured were in the range of 0-30 microg C/1, 30-120 microgC/1 and 0-90 microgC/1, respectively, in the various depths of Lake Kizaki. To determine the molecular weight distribution of dissolved organic matter in the water samples from Lake Kizaki, gel-filtration using Sephadex G-25 was applied. Volatile organic acids consisting of formic, acetic and propionic acids accounted for 59% of the dissolved organic carbon in the fraction of organic matter with a molecular weight of less than 200. The volatile organic acids were suggested to be the most ecologically significant materials in the matter cycle in the waters of the lake. (Baker-FRC)
W82-02720

PARTICULATE AND DISSOLVED LIPIDS IN SEA WATER,
Texas A and M University, College Station. Department of Oceanography.
M. C. Kennicutt, II.
PhD Dissertation, 1980. 239 p, 69 Fig, 44 Tab, 190 Ref, 7 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-23041.

Descriptors: *Seawater, Water properties, Organic compounds, Variability, *Lipids, *Water chemistry, Gulf of Mexico, Scotia Sea, Cariaco Trench.

Dissolved and particulate lipid extracts were collected at a number of locations in the Gulf of Mexico, the Scotia sea, and in and near the Cariaco trench. All concentrations of lipids measured were extremely low and apparently of biogenic origin. Seasonal, diurnal, vertical, and areal variations were observed in lipid content. The dissolved lipids were less variable than the particulate lipids. The lipid content of particulate organic carbon decreased with depth. Lipid concentrations reflected variations in routine oceanographic parameters such as salinity and temperature and the aperiodicity of sources. Anoxic conditions appeared to preserve lipid materials in the particulate phase. N-alkanes may have two sources (marine and terrestrial) superimposed on a low fairly constant background of hydrocarbons caused by lowlevel chronic oil pollution in the Gulf of Mexico. Fatty acid alkyl esters may be the product of the degradation of humic substances and glycerides; as such their distribution may indicate rates of degradation and the stability of the organic matter present in aquatic environments. Indanes, phenols, benzoates, and other compounds detected in this study may prove to be useful indicators of source. Lipids of temperate climates (Gulf of Mexico) and polar climates (Scotia Sea) had similar gravimetric concentrations and similar dominant compounds. The fractionated lipids had different distributions for the two locations. (Sinha-OEIS)
W82-02727

ECOLOGICAL MAGNIFICATION OF PERSISTENT ORGANOCHLORINE PESTICIDES IN AN ILLINOIS WATERSHED,
Illinois Univ. at Urbana-Champaign.
J. C. Marlin.
PhD Thesis, 1980. 114 p, 2 Fig, 49 Tab, 60 Ref. University Microfilms International, Ann Arbor, MI; Order No GAX80-26556.

Descriptors: *Water pollution, *Watersheds, *Pollutant identification, Insecticides, *Pesticides, Aquatic life, Ecology, Agriculture, Data collections, Fungicides, *Lake Decatur watershed, Illinois.

Data is provided on the accumulation of selected organochlorine insecticides in aquatic organisms in the heavily agricultural Lake Decatur watershed. Emphasis was placed on the collection of a wide vaariety of organisms in order to add to the data base on bioaccumulation within an ecosystem. DDT and DDE were chosen because they are known to be ubiquitous in the environment. Aldrin and heptachlor and their products, dieldrin and heptachlor epoxide, were selected because they have been widely used in the watershed to control soil insects, particularly corn rootworms. The fungicide HCB (hexachlorobenzene) was included since it was present in unexpectedly high concentrations in the first samples analyzed. The data show that aquatic organisms in the Lake Decatur watershed contain an abundance of organochlorine insecticide residues. Relatively high residues of aldrin and heptachlor were expected since their use was prevalent during the time data were collected. The ubiquitous presence of HCB was not anticipated. It provides another warning that the ultimate fate of chemicals in the environment should be studied prior to their use. The failure of insecticides to provide a permanent solution to insect pest problems as well as their threats to the environment and public health have prompted renewed interest in alternate control methods. Integrated pest management (IPM) combines cultural and biological control techniques with insect scouting, the judicious use of pesticides, and the acceptance of a limited amount of crop damage. (Sinha-OEIS)
W82-02741

STUDIES OF BIOLOGICAL NITROGEN CYCLE PROCESSES IN THE UPPER WATERS OF THE OCEAN, WITH SPECIAL REFERENCE TO THE PRIMARY NITRITE MAXIMUM,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2A.
W82-02742

THE DISTRIBUTION AND SEASONAL FLUCTUATIONS OF HETEROTROPHIC BACTERIA AND COLIFORM BACTERIA IN THE RIVERS AND ESTUARIES IN OSAKA CITY, JAPAN (IN JAPANESE),
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
T. Yoshikura, K. Oda, and S. Iida.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 46, No 2, p 231-236, February, 1980. 6 Fig, 7 Ref. (English summary).

Descriptors: *Coliforms, *Bacteria, *Water pollution effects, Rivers, Estuaries, Seasonal distribution, Temperature effects, *Japan, Microbial analysis, Fate of pollutants.

Water samples were collected at several stations in the rivers and estuaries in Osaka City and analyzed for microbial and chemical content. The waters were sampled monthly from April 1974 through March 1977. Heterotrophic bacteria were determined by the standard plate count at 37 deg C. Fluctuations in heterotrophic bacteria and coliform bacteria depended upon the concentrations of organic pollutants and on water temperature. Both bacteria concentrations reached a maximum at the most polluted station. When river water was diluted in the estuaries, coliform levels were higher than other bacterial levels. The maximum number of heterotrophic bacteria occurred during the summer. (Small-FRC)
W82-02774

NUTRIENT LOADING - TROPHIC STATE RELATIONSHIPS IN FLORIDA LAKES,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W82-02811

DETECTION OF OIL POLLUTANTS ON THE SURFACE OF INLAND WATERS BY A PROJECTOR-BASED OPTICAL DETECTOR,
Leningrad Electrical Engineering Inst. (USSR).
M. A. Kropotkin, T. Yu. Sheveleva, and V. A. Ivanov.
Water Resources (English Translation), Vol 7, No 6, p 582-585, November/December, 1980. 2 Fig, 2 Ref. Translated from Vodnye Resursy, No 6, p 167-171, November-December, 1980.

Descriptors: *Measuring instruments, *Oil pollution, *Optical properties, Oil spills, Oily water, Water pollution, Water properties, Weather.

An optical detector based on a light projector was evaluated on the Volga for the detection of oil spills. The detector was installed on a projecting boom mounted on the bow of the research ship so that the axis of the light beam was oriented to the water's surface. Direct and reflected solar radiation, changes in ambient air temperature, cloud cover, and light fog had no effects on the operation of the instrument. The detector operated successfully at ship speeds up to 15 knots and on fairly rough seas (wave height = 20-50 cm, wind speed to 10 m/sec). The minimum oil slick detectable was about 1.0 sq m. The optimal angle of incidence was 3-5 deg for the detection of oil pollution. The detector was used to determine the degree of oil pollution in the Volga and on Lake Baikal. (Small-FRC)
W82-02853

THE APPLICATION OF A WATER-QUALITY MODEL TO THE RIVER WYE, WALES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
A. C. Oborne.
Journal of Hydrology, Vol 52, No 1/2, p 59-70, June, 1981. 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Model studies, *Water quality, Rivers, Aquifers, Runoff, Flow, Chlorides, Phosphates, Hardness, Recharge, Chemical properties, Water pollution sources, *Wye River, *Wales.

The application of a simplified version of a flow separation model to modeling concentration changes of four water-quality determininands in the lower reaches of the River Wye was investigated. Mean daily river flows and levels of chloride, orthophosphate, total hardness and alkalinity for 1970-1977 were used to develop the model. Total river flow was assumed to consist of at least one baseflow component, a runoff component, and effluent return flows. The total mass flow of a given water quality determinand was assumed to represent the sum of the mass flows from all of these components, with correlation for the effect of storage in the river channel. A computer program with an iterative algorithm was used to obtain optimal values for the set of parameters. Performance of the model was assessed by comparing generated concentrations with observations from a data set other than that used for calibration. At least 79% of the test data variance was explained by the model for orthophosphate, alkalinity and total hardness, but only 59% for chloride. Prediction was significantly improved over that of the simple regression equation. The major source of error in the water quality model is the separation of flow into baseflow and runoff. The use of more than one baseflow component may have better represented this system. Further improvements in the quality model may also be achieved by using a longer flow record for calibration and a more complex approach to aquifer-recharge response than the present fixed recharge period approach. (Baker-FRC)
W82-02876

DIFFERENTIAL PULSE POLAROGRAPHIC DETERMINATION OF INORGANIC AND ORGANIC ARSENIC IN NATURAL WATERS,

Consiglio Nazional dele Ricerche, Bologna (Italy).
P. L. Buldini, D. Ferri, and Q. Zini.
Mikrochimica Acta, Vol 1, No 1-2, p 71-78, 1980. 1 Fig, 1 Tab.

Descriptors: *Pollutant identification, *Arsenic compounds, *Polarographic analysis, *Arsenic, Water analysis, Natural streams, Natural waters, Heavy metals, Oxidation, Anion exchange, Electrolysis.

A method for the determination of inorganic arsenic (III), arsenic (V), and organic arsenic at the microgram/liter level in natural waters by differential pulse polarography is described. For the determination of As(III), 4.2 ml of sample are transferred into a 5-ml standard flask and diluted to the mark with concentrated hydrochloric acid. After the solution is transferred to a polarographic cell and deaerated for 2 minutes, the peak heights are recorded and compared with a standard curve. For the determination of total inorganic arsenic, 100 ml of sample are placed in a 150-ml test tube to which 10 milligrams of potassium permanganate are added. The mixture is heated in the aluminum block until the volume is reduced to 2 ml. After anhydrous sodium sulfite and concentrated hydrochloric acid are added, the solution is heated for 1 hour at 90 degrees, cooled, then diluted to 5 ml in a standard flask. Polarographic analysis procedures are the same as those used for As(III). For determinations of total arsenic, 4 grams of magnesium nitrate hexahydrate and 20-50 milligrams of potassium permanganate are added to 100 ml of sample in a 150 ml test tube. The sample is subjected to nitrate removal steps. After the addition of anhydrous sodium sulfite and concentrated hydrochloric acid to the dry residue, polarographic procedures are the same as for total inorganic arsenic. Techniques to overcome Cu(II) and Pb(II) interferences are described. The overall efficiency of the method is 70-80%. (Geiger-FRC)
W82-02903

POLYCHLORINATED BIPHENYLS IN SEWAGE SLUDGE AND SEDIMENTS OF THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
R. H. West, and P. G. Hatcher.
Marine Pollution Bulletin, Vol 11, No 5, p 126-129, May, 1980. 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Polychlorinated biphenyls, *Sludge, *Marine sediments, Bottom sediments, Sediments, *New York Bight, Pollutants, *Ocean dumping, Waste disposal, Spoil banks, Municipal wastewater, Bights.

The horizontal and vertical distribution of PCBs in sediments in the New York Bight were measured, and particulate and dissolved PCB concentrations were monitored over several hours following the dumping of sewage sludge in the Bight. Analyses of four sewage sludge samples demonstrated the presence of high concentrations of PCBs, in spite of the current limited use of these substances. Sampling of the surface plume shortly after ocean dumping of sewage sludge revealed dramatic increases in dissolved and particulate PCB levels. After the initial increase, an overall decrease in dissolved PCBs and increase in particulate PCBs was observed as a function of time. Large quantities of PCBs are rapidly removed from the water column by scavenging particulate matter and transported to surficial sediments over a relatively limited area, usually less than 1 to 2 kilometers in breadth. A significant concentration of PCBs is retained in the water column and remains in suspension in the mixed layer for longer periods of time. Concentration of the sedimentary PCBs in the Christiaensen Basin, where sewage sludge is known to accumulate, suggests that this sludge is the primary source of PCBs in the Bight. High PCB levels appear to be restricted to a very small area typified by mud accumulation, and widespread transport of PCBs out of the Bight is not evident. Analysis of the vertical concentrations of PCBs in a box core taken from the most heavily contaminated areas shows that the surface PCB concentration is significantly higher than concentrations detected further down in the core. The analyses indicate that high PCB levels have existed ever since widespread use of the compounds began in 1955, and that the levels of PCBs are correlated with dramatic increases in the volume of sludge dumped in the Bight since 1952. (Carroll-FRC)
W82-02904

MORPHOLOGICAL CHANGES IN TOXIC AND NON-TOXIC MICROCYSTIS ISOLATES AT DIFFERENT IRRADIANCE LEVELS,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W82-02906

URANIUM ISOTOPES AND 226RA CONTENT IN THE DEEP GROUNDWATERS OF THE TRI-STATE REGION, U.S.A.,
Florida State Univ., Tallahassee. Dept. of Geology.
J. B. Cowart.
Journal of Hydrology, Vol 54, No 1-3, p 185-193, December, 1981. 3 Fig, 3 Tab, 10 Ref.

Descriptors: *Isotope studies, *Radium, *Drinking water, *Groundwater, Deep wells, Public health, Brines, Missouri, Oklahoma, Kansas.

Uranium isotopes 238U and 234U, precursors of 226Ra, were studied in an investigation of the unacceptably high radium concentration (greater than 5 pCi/liter) in public water supply wells in the Missouri, Kansas, and Oklahoma area. The high-Cl brine in the area may be the source of the radium. There are no appropriate samples presently available from the area, although high radioactivity has been reported from oil-field wells further west in Kansas and Oklahoma. At least part of the dissolved uranium in the westward flowing water is precipitated in the zone of mixing. The waters mix, then flow southwestward. Thus, the radium is not due to present day accumulation. (Small-FRC)
W82-02939

DEVELOPMENT OF A MULTIDETECTOR PETROLEUM OIL-IN-WATER MONITOR,
Rockwell International, Newburg Park, California.
R. W. Melvold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-105206, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-206, October, 1981. 3 Fig, 1 Tab.

Descriptors: *Monitoring, *Petroleum products, *Oil, Water pollution, Fluorescence, *Oil pollution, Brackish water, Seawater, Pollutant identification.

No satisfactory commercially available instrument or concept presently exists for continuously measuring all types of oil in various physical states (free, suspended, dissolved, or emulsified) in water containing various types and concentrations of matrix materials. The complex chemical composition of petroleum-derived oils and the similarities of oil components to nonpetroleum water contaminants dictate the use of a multidetector monitoring system for the improved measurement of petroleum oil in water containing nonpetroleum contaminants. To determine the feasibility of developing a multidetector monitoring system, a survey was conducted of commercially available oil monitors. Three monitors were recommended for inclusion in the multidetector system: the Sigrist Fluorescence Monitor Model FLJ (UV fluorescence) the CE Invalco D.O. W. Monitor (UV absorbance), and the Horiba OCMA-32A Oil Content Monitor (infrared absorbance). A comprehensive evaluation of the selected oil meters was critically conducted under laboratory conditions to identify their ability to detect and quantify petroleum oil in fresh, brackish, or sea water. The multidetector concept has been demonstrated as a viable technique for the measurement of petroleum oil in water containing nonpetroleum contaminants. A preprototype multidetector system has been assembled and tested; it is a definite improvement over any single commercially available detector. (Moore-SRC)
W82-02964

DETERMINATION OF PHTHALATES IN INDUSTRIAL AND MUNICIPAL WASTEWATERS,
Southwest Research Inst., San Antonio, TX.
J. W. Rhoades, R. E. Thomas, D. E. Johnson, and J. B. Tillery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-232167, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-81-063, October, 1981. 5 p, 3 Tab.

Descriptors: *Pollutant identification, *Municipal wastewater, *Industrial wastewater, *Phthalates, *Gas chromatography, Electron capture gas chromatography, Sample preservation, Water sampling.

As part of a series of investigations of the analytical behavior of selected priority pollutants and suitable test procedures for their measurement, the following compounds were studied: dimethyl phthalate (DMP); diethyl phthalate (DEP); dibutyl phthalate (DBP); benzyl butyl phthalate (BBP); diethylexyl phthalate (DEHP); and dioctyl phthalate (DOP). All six phthalates have been chromatographed on two columns. Column 1 is packed with 1.5% SP-2250 plus 1.95% SP 2401 on 100/120 mesh Supelcoport. Column 2 has 3% OV-1 as its liquid phase but is otherwise the same as Column 1. Investigations with both columns gave comparable results. The electron capture detector is preferred over the flame ionization detector on the bases of the greater sensitivity and selectivity. Based on extraction studies using clean water, 15% dichloromethane in hexane should be used as the solvent for extracting wastewaters. Acceptable recovery was obtained for phthalate esters when the background of electron capture sensitive materials was low. When interferences were present, clean-up procedures did not allow the phthalates to be quantitated in microgram/l concentrations. The recoveries that can be expected for the compounds studied ranged from 40 to 100%, depending upon the compound and the wastewater studied. Storage frequently resulted in significant losses of the study materials and in less precise determinations. (Moore-SRC)
W82-02999

5B. Sources Of Pollution

MANAGEMENT OF GROUND WATER CONTAMINATED BY AROMATIC HYDROCARBONS IN THE AQUIFER SUPPLYING AMES, IOWA,
Southern Illinois Univ. at Carbondale. Coal Extraction and Utilization Research Center.
H. Yazicigil, and L. V. A. Sendlein.
Ground Water, Vol 19, No 6, p 648-665, November/December, 1981. 12 Fig, 3 Tab, 34 Ref.

Descriptors: *Aromatic compounds, *Coal gasification, *Water pollution treatment, Path of pollutants, Water pollution sources, Hydrocarbons, Organic compounds, Ames, Iowa, Model studies, Water pollution control, Waste disposal, Chemical wastes, Industrial wastes, Waste dumps, *Groundwater pollution.

A digital model and field monitoring data were used to evaluate alternatives for handling a coal tar residues dump and the resulting pollution of the unconsolidated buried channel aquifer supplying Ames, Iowa. Wastes from a coal gasification plant were deposited in a pit from 1910 to the late 1920's. Several city wells were abandoned and some are presently threatened because of tastes and odors from the chemicals. A variety of hydrocarbons and other organic compounds, mostly aromatic, have been identified in contaminated well water: benzenes, indenes, naphthalenes, styrenes, indoles, and many others. Management practices considered were: (1) removal of the residue with maintenance of the present pumping practices, (2) construction

of a pump trough barrier and a protective pump well, (3) regulation of drawdown and recovery periods in municipal wells, (4) regulation of pumping in city wells, (5) expansion of the well field to the northeast, and (6) a new well field to the southeast. None of the alternatives, used alone, offered a practical solution to the problem. It was recommended that two localized coal tar residue sources be excavated and a pumping trough barrier with protective pumping well be constructed. If no remedial measures are taken, the well field must be expanded to the west or the water system connected with the Iowa State University well system. (Cassar-FRC)
W82-02611

AQUIFER DECONTAMINATION FOR VOLATILE ORGANICS: A CASE HISTORY,
New Jersey Bureau of Ground Water Management.
For primary bibliographic entry see Field 5F.
W82-02613

IMPACT OF DREDGED MATERIAL DISPOSAL UPON GROUND-WATER QUALITY,
Calscience Research, Inc., Huntington Beach, CA.
R. D. Morrison, and K. Y. Yu.
Ground Water, Vol 19, No 3, p 265-270, May/June, 1981. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Water quality, *Dredging, *Land disposal, Fate of pollutants, Water pollution sources, *Leachates, Solute transport, Sodium, Chlorides, Potassium, Sediments, Dilution, Chelation, Chemical precipitation, Sulfides, Manganese, Iron, Alkalinity, Water hardness, *Groundwater pollution, Adsorption, Weathering, Chemical reactions, Trace metals.

Groundwater was monitored over a 2-yr period at three dredge disposal sites: Grandhaven, Michigan (freshwater); Mobile, Alabama; and Sayreville, New Jersey (both estuarine). Leachate samples collected from monitoring wells and vacuum/pressure lysimeters were analyzed for 27 water quality parameters. Na, Cl, and K concentrations were high (maximum 4310, 8330, and 250 mg per liter, respectively) in groundwater sites where saline dredge material was deposited. Dilution is the major mechanism regulating transport of these ions. Mg and Ca maxima were 720 and 380 mg per liter, respectively, representing significant increases in water hardness over background levels. Mechanisms for transport of Mg and Ca are dilution, precipitation/dissolution, and ion exchange. Alkalinity ranged from undetectable to 1000 mg per liter and was controlled by dissolution of carbonates, weathering, and oxidation-reduction reactions. Total organic carbon was highly correlated with alkalinity. Maximum iron and manganese levels were 538 and 12 mg per liter, respectively, above the recommended EPA drinking water quality standards. Sulfides were generally below 20 mg/kg. Phosphate, Cd, Cu, Pb, Ni, Hg, and Zn occurred in concentrations too small to have significant effects on groundwater quality. Major controlling factors for these ions are complexation, adsorption, and precipitation/dissolution. (Cassar-FRC)
W82-02615

THE PREDICTION OF RAIN ACIDITY AND SO2 SCAVENGING IN EASTERN NORTH AMERICA,
Atmospheric Environment Service, Downsview (Ontario).
L. A. Barrie.
Atmospheric Environment, Vol 15, No 1, p 31-41, 1981. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Acid rain, North America, Rainfall, Model studies, Prediction, *Hydrogen ion concentration, *Sulfur compounds, Air pollution, Water pollution sources, Forecasting, Acidity, Projections, Sulfates, Aerosols, Path of pollutants.

The role of sulfur dioxide as a rainwater acidifying agent is examined. A quantitative relationship between the sulfur (IV) content of rain, rainwater pH and temperature is derived which can be used in long-range transport models to simulate the sulfate scavenging process mathematically. Methods of calculating precipitation acidity and thus sulfur dioxide washout are demonstrated for various rainwater chemistry data sets. Based on the equilibrium solution chemistry of sulfur dioxide, it is concluded that, for the purposes of long-range transport models, sulfur dioxide scavenging by rain can be calculated using a washout ratio approach, provided that the temperature and acidity of rain are taken into account. It is also concluded that dissolved sulfur dioxide can contribute a significant fraction of the total hydrogen ions deposited in rainfall, particularly at near zero degrees C, in air containing aerosols of low acidity such as ammonia neutralized sulfuric acid particles. If long term trends in the acidity of rain are to be explained, dissolved sulfur dioxide should be measured in precipitation. The sulfur dioxide scavenging process must also be realistically simulated in models. To accomplish this one must be able to predict precipitation acidity. The strong relation between the hydrogen ion and sulfate ion contents of rain in acid sensitive areas of eastern North America enables one to predict precipitation acidity from models of the sulfur cycle. Nitrogen oxides are also important, but their cycles are not so well known. More study is also needed in order to parameterize sulfate aerosol washout. (Baker-FRC)
W82-02628

FARM, URBAN DRAINAGE POLLUTING GREAT LAKES.
Water and Pollution Control, Vol 118, No 7, p 26, July, 1980.

Descriptors: *Lakes, *Nonpoint pollution sources, *Great Lakes, Farming, Urban runoff, Lead, Mercury, Phosphorus, Eutrophication, Algal growth, Drainage effects, Environmental effects, Urban drainage, Agricultural runoff, Industrial wastes.

A comprehensive study was conducted over 11 years of pollution problems in the Great Lakes area. A new approach was seen as needed for controlling land drainage non-point pollution. The approach recommended calls for closer coordination between and within the Governments of the two joining countries, Canada and the United States. Such cooperation is necessary to overcome gaps and inconsistencies in the several government programs that affect the actions of individual firms, urban dwellers, cottagers and farmers, all of whom contribute to this type of pollution. Considerable attention must be given to the local level implementation of the programs. Specific instances where regulation is needed include the disposal of hazardous industrial wastes, sediment control in urban areas, and the spreading of manure on frozen agricultural land during the winter. At present agricultural practices are responsible for the majority of phosphorus which finds its way into water bodies and causes excessive algal growth. Toxic and hazardous chemicals are also of great concern, and while some have been declining in their presence in water and fish, other problems are emerging. Lead, largely from vehicle exhausts carried through the air, is now found throughout the Great Lakes sediments and could present a problem similar to that of mercury contamination. Hazardous waste disposal must be more closely controlled. Conservation of resources and recycling of many products are urged. (Baker-FRC)
W82-02647

KINETICS OF MONOCHLORAMINE DECOMPOSITION IN THE PRESENCE OF BROMIDE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
T. W. Trofe, G. W. Inman, Jr., and J. D. Johnson.
Environmental Science and Technology, Vol 14, No 5, p 544-549, May, 1980. 9 Fig, 3 Tab, 19 Ref.

Descriptors: *Chlorine, *Monochloramine, *Cooling water, Electric powerplants, Chemical reactions, Toxicity, *Bromides, Seawater, Estuarine environment, Kinetics, Organic compounds, Biocides, Water treatment, Fate of pollutants, *Cape Fear River estuary, North Carolina.

Monochloramine, a reaction product of chlorine and natural waters (especially estuarine and marine) found in cooling waters discharged from electric powerplants, is persistent and toxic to aquatic life. Decomposition in the presence of bromide, which occurs naturally in seawater, produced a previously unidentified product, NHBrCl. In artificial seawater, the reaction between monochloramine and bromide ion was first order with respect to monochloramine, bromide ion, and hydrogen ion concentration over the pH range 6.8-8.2. The overall empirical rate constant at 25C was evaluated as 2.8 times 10 to the 6th power M squared/sec. Bromide oxidation is the primary pathway for monochloramine removal in highly saline waters. This conclusion was confirmed by spiking a sample of unfiltered water from the Cape Fear River estuary with monochloramine and measuring the concentration by UV absorbance. The water salinity was 33.6 parts per thousand. The observed half-life of monochloramine, 3-4 hr, was in good agreement with the predicted half-life of 5 hr. Bromochloramine (NHBrCl) is expected to be less stable in aqueous solution than monochloramine. However, research is needed on NHBrCl toxicity to marine organisms. (Cassar-FRC)
W82-02651

SEEPAGE FROM FREE WATER ABOVE IMPERMEABLE TAILINGS,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
L. T. Isaacs, and B. Hunt.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT11, p 1563-1577, November, 1981. 8 Fig, 14 Ref.

Descriptors: *Seepage, *Mine wastes, *Mathematical models, Spoil banks, Dams, Stability analysis, Water pollution sources, Mathematical studies.

A model is proposed for the entry region of the discharge from free water above impermeable tailings, and an analytical solution is presented. Seepage analysis was performed to estimate the amount of water leaving a tailing structure as seepage, to determine pore pressures for stability analysis, to estimate the exit point, and to estimate the seepage velocities. Experimental results indicated that the theory will yield reasonably accurate estimates of the discharge when field conditions are close to those assumed in the model. Results were compared to those of Thomson and Rodin and with the half triangular ditch solution. (Small-FRC)
W82-02714

FORMS OF HEAVY METALS IN THE SETTLING MATTER FROM A MAN MADE LAKE (IN JAPANESE),
Aichi Environmental Research Center, Nagoya (Japan).
H. Otsuka.
Japanese Journal of Limnology, Vol 42, No 1, p 28-39, 1981. 6 Fig, 8 Tab, 20 Ref.

Descriptors: *Heavy metals, *Sedimentation, *Fate of pollutants, *Organic matter, *Adsorption, Iron, Manganese, Copper, Nickel, Cadmium, Zinc, Metals, Metal complexes, Artificial lakes, Separation techniques, *Lakes, Suspended sediments, Suspended solids, Path of pollutants.

Heavy metal settling in a productive man-made lake was examined by selective extraction of water samples collected at various depths each month for an 18 month period. The largest amount of metals was extracted with hydrochloric acid. More than 80% of the Fe recovered was by extraction with hydrofluoric acid. A small amount of Cu was extracted with hydrogen peroxide. The quantities of metals extracted varied seasonally, with distinctive patterns among metals and fractions. The most important form of metals in lake water appeared as adsorbed or coprecipitated forms on organic matter or as hydrous Fe/Mn oxides. Significant amounts of Cu were bound to organic matter. Zn, Ni, and Cd were associated with Mn oxides and organic matter, while Cu was found frequently with Fe and Mn oxides. It was suggested that the sedimentation of metals within the lake was closely related to the cyclic patterns of Fe, Mn, and organic matter. (Geiger-FRC)
W82-02719

STUDIES ON THE ABILITY OF A POTAMOGETON PECTINATUS COMMUNITY TO REMOVE DISSOLVED NITROGEN AND PHOSPHORUS COMPOUNDS FROM LAKE WATER,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
C. Howard-Williams.
Journal of Applied Ecology, Vol 18, No 2, p 619-637, August, 1981. 5 Fig, 9 Tab, 41 Ref.

Descriptors: *Aquatic plants, *Algae, *Nutrient removal, Fate of pollutants, Wastewater treatment, Macrophytes, Potamogeton, Nitrogen, Phosphorus, Submerged plants, Sediments, *Lakes, Lake Sediments, Chlorophyll a, Phytoplankton, Epiphytes.

Enclosures containing dense growths of Potamogeton pectinatus were enriched weekly for 15-23 weeks with the following amounts of P and N (in mg per cu meter), respectively: low, 5 and 50; medium, 10 and 100; high, 25 and 250; and extra high, 100 and 1000. Chlorophyll a levels remained low in all treatments, but filamentous epiphytic algae (predominantly Cladophora sp.) developed in proportion to the degree of enrichment. After 9 weeks nutrients added at all levels were utilized within 1 day. Potamogeton plants were not adversely affected by these dense algal mats. P32 tracer experiments showed that most of added P was absorbed within 2 hours by the filamentous algae. N and P levels were increased in algae by the extra high treatment only. Enrichment resulted in increased N concentrations in leaf, stem, root, and rhizome of Potamogeton at high and extra high treatment levels; increased P absorption was seen only in the extra high treatment. Organic matter, N, and P were significantly higher in the top 1 cm of sediments with the extra high treatment only. Beds of dense submerged macrophytes with associated algae may be useful as nutrient filters at fairly low P loads (100 micrograms per liter per week soluble P) in large water bodies, for example, septic tank flows or agricultural runoffs which drain into lakes or rivers. (cassar-FRC)
W82-02724

CROPLAND, BUFFER, AND STREAM: A CASE STUDY IN AGRICULTURAL NONPOINT SOURCE WATER POLLUTION,
Michigan State University, Department of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W82-02728

HYDROCHEMICAL CHARACTERISTICS OF THE STREAM DRWINKA AND ESTIMATE OF ITS SELF-PURIFICATION ABILITY,
Jagellonian Univ., Krakow (Poland). Dept. of Hydrobiology.
K. Jop.
Acta Hydrobiologica, Vol 22, No 3, p 249-262, 1980. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Rivers, *Chemical properties, *Industrial wastes, *Poland, Municipal wastes, Water pollution sources, Self-purification, Aquatic plants, Biological oxidation, *Fate of pollutants.

The hydrochemical character of the stream Drwinka, the degree of its pollution, and the process of its self-purification were examined. The Drwinka basin lies in the River Vistula's dead channel. A distinct depression of the terrain is noted along the course of the Drwinka, parallel to the Vistula. This depression is lined with a layer of sandy-gravelly quaternary sediment covered with silts and with formations of marshy accumulation. The ground water is very rich owing to the great thickness of quaternary alluvial sediments. The present bed of the Drwinka and its tributaries are modified by trimming and by land reclamation of the neighboring areas. The chief and constant sources of pollution are municipal sewage and wastes from a poultry farm at Niepolomice. Both are fed directly to the stream through five collectors located in Niepolomice. Pollution also arrives here from the Lenin Steel Works. The self-purification for this river occurs mainly in a 5 kilometer sector below Niepolomice. In the first 5 kilometers below the inflow of wastes the biochemical oxidation or organic matter occurred. For the next section of the river vascular plants played a marked role by assimilating great amounts of nutritive compounds. A 35% decrease in the mean concentration of most macroelements occurred in this area. Even with this cleaning process, the content of nutritive compounds in the water at the last measurement station was significantly higher than that occurring in natural waters. (Baker-FRC)
W82-02750

COMPARISON OF THE CHEMICAL COMPOSITION OF THE WATERS OF LAKE PIASECZNO (LECZYNSKO-WLODAWSKIE LAKE DISTRICT) AND OF THE SHALLOW GROUND WATERS IN ITS CATCHMENT AREA,
Akademia Rolnicza, Lubin (Poland), Inst. Gleboznawstwa i Chemii Rolnej.
For primary bibliographic entry see Field 2H.
W82-02752

PLUTONIUM OCCURRENCE AND PHASE DISTRIBUTION IN SEDIMENTS OF THE WYRE ESTUARY, NORTHWEST ENGLAND,
International Lab. of Marine Radioactivity, Monte carlo (Monaco). Oceanographic Museum.
S. R. Aston, D. J. Assinder, D. A. Stanners, and J. E. Rae.
Marine Pollution Bulletin, Vol 12, No 9, p 308-314, September, 1981. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Plutonium, *Estuaries, *Path of pollutants, Fate of pollutants, Mercury, Sediments, *Wyre Estuary, Ravenglass Estuary, *England, Windscale, Nuclear fuel processing plants, Isotope studies, Organic matter, Particle size.

Distributions of plutonium isotopes were determined in Wyre Estuary, northwest England, about 60 km south of the Windscale nuclear fuel reprocessing plant. In surface samples Pu238 concentrations were 0.25-2.9 pCi per g and Pu239+240, 1.15-27.5 pCi per g. These levels are < 25% of typical values found in surface sediment samples at Ravenglass Estuary, 10 km south of Windscale. Ratios of Pu238:Pu239 were almost constant, 0.23, which indicates that Pu is deposited in surface sediments about 4 years after deposition at Ravenglass, or a total of 6-7 years after release in effluents and fallout at Windscale. Pu concentrations were correlated with total organic carbon, which may be a function of grain size. Leaching studies showed that only 20% of Pu was associated with Fe and Mn hydrous oxides, considerably less than in Ravenglass samples. This lends further support to the hypothesis that Pu is associated with organic matter (but not humic substances) in this site. Examination of 30 cm sediment cores showed that Pu239 levels were well correlated with Hg and total organic carbon throughout the core depth. (Cassar-FRC)
W82-02760

THE INFLUENCE OF STREAM SALINITY ON RESERVOIR WATER QUALITY,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W82-02762

GROUNDWATER SYSTEMS ASSOCIATED WITH SECONDARY SALINITY IN WESTERN AUSTRALIA.
Western Australia Dept. of Agriculture, South Perth. Div. of Resource Management.
For primary bibliographic entry see Field 2F.
W82-02770

THE DISTRIBUTION AND SEASONAL FLUCTUATIONS OF HETEROTROPHIC BACTERIA AND COLIFORM BACTERIA IN THE RIVERS AND ESTUARIES IN OSAKA CITY, JAPAN (IN JAPANESE),
Osaka City Inst. of Public Health and Environmental Sciences (Japan).
For primary bibliographic entry see Field 5A.
W82-02774

RUNOFF AND POLLUTION ABATEMENT CHARACTERISTICS OF CONCRETE GRID PAVEMENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Architecture and Urban Studies.
G. E. Day, D. R. Smith, and J. Bowers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168469, Price codes: A04 in paper copy, A01 in microfiche.
Virginia Water Resources Research Center, Virginia Polytechnic Inst. and State Univ. Bulletin 135, October, 1981. 59 p, 6 Fig, 21 Tab, 22 Ref. OWRT-A-090-VA(1).

Descriptors: *Concretes, *Urban runoff, Storm runoff, Stormwater management, Heavy metals, Nitrogen, Nutrients, Phosphorus, Plant nutrients, *Water pollution control, *Comparison studies, *Pavement, Concrete pavement, Concrete grid pavement.

Problems of water quality and quantity have forced many communities to redefine the approaches to local stormwater management. New approaches-alternatives to the conventional means of piping a problem downstream--focus on maintaining predevelopment runoff levels by increasing opportunities for runoff infiltration, by controlling runoff velocities and volumes, and by reducing nonpoint pollutants. Concrete grid pavements have potential as a technology capable of performing these functions, but they have not yet been evaluated to the satisfaction of officials who must endorse or implement stormwater management strategies. This research measured, in a laboratory setting, runoff volume and pollutant load reductions associated with three types of grid pavements. A concrete slab was used as a control. Reductions in pollutant concentration and mass in water that percolated through the grids in the pavements were also measured. Runoff from the surface of the pavements and from water within the soils beneath the pavements was analyzed for phosphorus, nitrogen, organic carbon chromium, lead, and zinc. Results show that the grid pavements greatly reduced runoff volume, as compared to the concrete slab. The masses of 10 pollutants found in the runoff from this slab were much greater than those in the runoff from the grid pavements. The soils beneath the grid pavements acted effectively in removing significant quantities of pollutants from the water that infiltrated into them.
W82-02801

A REEXAMINATION OF THE ZOOPLANKTON COMMUNITY OF A DELAWARE TIDAL STREAM,
Delaware Univ., Newark. Coll. of Marine Studies.
M. P. Van House.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168501, Price codes: A06 in paper copy, A01 in microfiche.
MS Thesis, August, 1981. 96 p, 7 Fig, 29 Tab, 94 Ref, Append. OWRT-A-044-DEL(2), 14-34-0001-9008.

Descriptors: *Zooplankton, *Tidal rivers, Estuaries, *Wastewater disposal, Water pollution sources, *Water pollution effects, Murderkill River, Broadkill River, *Delaware, Water quality.

The zooplankton community of the Murderkill River, a shallow estuary in southeastern Delaware, was studied in an earlier comparison of two rivers of differing water quality. At that time the Murderkill was an unperturbed system and the nearby Broadkill received considerable point source pollution. Since that time a regional wastewater treatment plant began operation, discharging its effluent through a tiny creek into the Murderkill, and several studies have documented water quality changes in the river. The present study is a qualitative and quantitative survey of the present zooplankton community in an attempt to detect changes that were predicted to accompany changes in water quality. Three indices of community analysis, percent similarity, rank correlation coefficient and diversity of change indicated that samples in the present study were similar to those collected before the treatment plant opened in relative abundance of dominants, rank and frequency of dominants and number and magnitude of

species changes. Analysis of individual groups of zooplankters such as rotifers, calanoid copepods, cyclopoid copepods and cladocerans revealed some shifts in species and relative abundances but the changes appeared to reflect differences in parameters such as a salinity rather than water quality. At present effluent levels, the zooplankton of the Murderkill River does not appear to have changed significantly following changes in water quality.
W82-02805

NUTRIENT LOADING - TROPHIC STATE RELATIONSHIPS IN FLORIDA LAKES,
Florida Univ., Gainesville. Water Resources Research Center.
L. A. Baker, P. L. Brezonik, and C. R. Kratzer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168568, Price codes: A07 in paper copy, A01 in microfiche. Publication No 56, 1981. 126 p, 43 Fig, 23 Tab, 88 Ref, 4 Append. OWRT-A-038-FLA(1), 14-34-0001-9010, 14-34-0001-0110.

Descriptors: Trophic state indicators, Watershed enrichment factors, *Nutrients, *Land use, *Trophic level, Nitrogen, Phosphorus, *Lakes, *Florida, Model studies, Nutrient loading.

Relationships among trophic state indicators and watershed enrichment factors were examined for 101 Florida lakes. Regression analysis was used to examine the relationship between land use and NPS nutrient loadings. The best model to predict NPS P loading included three land use variables while total drainage area alone was a good predictor of NPS N loading. Florida lakes were found to be shallow; few exhibit stable stratification or seasonal trends in chlorophyll a or nutrient concentrations. Many are N-limited; there is less chlorophyll a for a given level of P (even for P-limited lakes) than found in temperate lakes. The best predictions of N and P in Florida lakes are made using a modified Dillon-type model; the best predictions or chlorophyll a are made using Jones and Bachman-type model. The 1975 Vollenweider criteria and the Dillon criteria were modified to improve their predictive capabilities: in both cases the revisions resulted in higher critical loading rates. N loading criteria were developed; the best N loading criteria were based on a Dillon-type model. The correct response of a lake to alterations in nutrient loading will be obtained using the criteria (N or P) that predicts the lower trophic status. (Heaney-FLA)
W82-02811

PHYSICAL CHARACTERIZATION OF EXTRACHROMOSOMAL DNA IN CHESAPEAKE BAY BACTERIA FROM POLLUTED AND NON-POLLUTED SITES,
Maryland Univ., College Park. Water Resources Research Center.
D. L. Glassman, and L. A. McNicol.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168592, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 66, 1980. 78 p, 14 Fig, 15 Tab, 109 Ref, 4 Append. OWRT-A-050-MD(1), 14-34-0001-0122.

Descriptors: *Bacteria, *Ecosystems, *Chesapeake Bay, Estuarine environment, *Plasmids, Extrachromosomal DNA elements, Ecological effects.

The significance of extrachromosomal elements in natural populations of estuarine bacteria has not been determined. To obtain measure of the frequency of plasmids in this ecosystem, a random sample of the total aerobic heterotrophic community was collected from the Chesapeake Bay. Two hundred eighteen strains were examined by agarose gel electrophoresis, using an in-the-well lysis procedure. Forty four percent of these isolates carried at least one plasmic. This proportion did not vary significantly between three different sampling locations which span an enormous range of water quality. In general, organisms isolated from cleaner stations contained predominantly single, small plasmids with a molecular weight of three to five megadaltons. A significantly large percentage of bacteria isolated from Baltimore's inner harbor tended to carry multiple plasmids and plasmids greater than 30 x 10 degrees molecular weight. Plasmids were identified in organisms representing all the major taxonomic components of the estuarine aerobic heterotrophic community. Plasmids of the three to five megadalton size class were found to be extremely ubiquitous. DNA-DNA hydridization analysis between plasmid DNA from several isolates indicate that within a group of heterogeneous small cryptic plasmids may exist several groups of structurally related plasmids of both narrow and broad host range. Future work will be needed to further determine the extent of these homologies.
W82-02814

WATERSHED IMPACT ON STREAM WATER QUALITY: A TECHNIQUE FOR REGIONAL ASSESSMENT,
Wisconsin Univ., La Crosse. River Studies Center.
M. M. Smart, T. W. Barney, and J. R. Jones.
Journal of Soil and Water Conservation, Vol 36, No 5, p 297-300, September-October, 1981. 2 Fig, 3 Tab, 16 Ref. OWRT-A-111-MO(3).

Descriptors: *Water quality, *Land use, *Watersheds, Water pollution sources, Forests, Missouri, Urban areas, Farming, Chemical analysis, Streams, Ozarks, Baseline studies.

The use of general watershed data has been demonstrated in assessing the influence of watersheds on stream water chemistry. The Spring Creek watershed in Douglas County, Missouri, serves as an example of how such an assessment can be made. A total of 21 watersheds and streams were studied in an 11 county region of south central Missouri. Spring Creek is typical of watersheds in the Salem Plateau. There are no known point sources of chemicals. Land use consists of 86.3% forest, 13.6% pasture and 0.1% urban. Stream water samples were collected every 10 days from June 1978 to September 1979. Regression equations were developed to assess the relationships between the characteristics of the watershed. The areas of urban land and pasture on a watershed were associated with increased concentrations of most chemicals in streams. Inverse relations were noted between forest land use and the concentration of most chemicals in the streams. As the area of forest land on a watershed increased, stream chemical concentrations declined. Concentrations of chemicals and chlorophyll a in Spring Creek were generally low. Depending on the season, total phosphorus ranged from 7.6 to 19.9 milligrams per cubic meter. What effect land use changes in the Spring Creek watershed might have on water chemistry and algal biomass can be assessed using the empirical regression equations developed from the watershed-stream data base for late summer. Streams draining forest areas unaffected by human activity likely represent the background level of stream chemical concentrations in the Missouri Ozarks. (Baker-FRC)
W82-02818

KINETICS OF TRACE METAL PARTITIONING IN MODEL ANOXIC MARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
S. M. Oakley, C. E. Delphey, K. J. Williamson, and P. O. Nelson.
Water Research, Vol 14, No 8, p 1067-1072, August, 1980. 6 Fig, 2 Tab, 12 Ref. OWRT-A-044-ORE(2), 14-34-0001-9039.

Descriptors: *Marine sediments, *Trace metals, *Anaerobic conditions, *Estuaries, *Kinetics, Sediments, Interstitial water, Geochemistry, Seawater, Salt water, Brackish water, Saline water, Spectrophotometry, Solubility, Leaching, Equilibrium, Copper, Cadmium, Lead, Zinc, Heavy metals.

A model anaerobic sediment consisting of humic acid, clay, ferrous, sulfide, sand, and seawater was utilized to study the partitioning of copper, cadmium, lead, and zinc between different geochemical phases. An extraction scheme was developed that was selective for each phase. The scheme involved separating the humic material and treating the remaining clays with nitric acid to strip the metals and to disolve the ferrous sulfide. Centrifuging then isolates the solid fraction, which contains trace metals associated with the ferrous sulfide. Metals dosed on sediment phases were extracted and analyzed using spectrophotometry. Results indicate that the kinetics of partitioning were rapid, regardless of which phase was dosed. Equilibrium was reached within two to five days. The final metal distributions show that adsorbing surfaces can significantly increase the quantities of metals that exist outside the sulfide phase. Thus, the metal sulfide phase may not be the dominant sink for trace metals in anaerobic sediments. (Titus-FRC)
W82-02820

EFFECTS OF RECREATION ON WATER QUALITY IN GUADALUPE MOUNTAINS NATIONAL PARK,
Texas Tech Univ., Lubbock. Dept. of Civil Engineering.
D. H. Dasher, L. V. Urban, M. J. Dvoracek, and E. B. Fish.
Transactions of the ASAE, Vol 24, No 5, p 1181-1187, September-October, 1981. 4 Fig, 36 Ref. OWRT-B-206-TEX(3).

Descriptors: *Water pollution sources, *Recreation facilities, McKittrick Canyon, Streams, *Texas, *Guadalupe Mountains National Park, Water quality, Sediments, Water analysis, Chemical composition, Leaves, Cesspools, Wastewater disposal.

Water quality was studied in the Guadalupe Mountains National Park, Texas. Livestock and wildlife have been the most frequent users of some areas. Guadalupe Spring was developed as a major source of water for both livestock and human needs of park service personnel living below Guadalupe Pass. In 1979 this spring flow was diverted to a natural water supply for wildlife following the development of a deep well at the park service housing site. Sewage effluents from both North and South McKittrick Canyons were disposed of in cesspools on alluvial terraces near the channel. Seventeen sampling sites were selected for periodic water quality analysis, including springs, surface water sampling stations and a well. All sampling was conducted during steady state base flow conditions. The chemistry of the waters reflected the sedimentary geology of the region. The water reflected a well buffered calcium carbonate-magnesium carbonate system. The principal ion was usually bicarbonate, while sulfate was the second most prevalent anion. These results accord well with water chemistry data from different areas of sedimentary deposits. Nutrient levels of nitrate-nitrogen and orthophosphate do not appear excessive considering the natural inputs, such as autumn leaf litter. Recreational use at present has not significantly affected or degraded water quality of the springs. There may have been some impact on quality in McKittrick Canyon stream. The actively used cesspool at the Pratt area may represent a present and certainly a future source of pollutants to this stream. (Baker-FRC)
W82-02821

NITROGEN RECYCLING IN A NORTH CAROLINA COASTAL RIVER,
North Carolina State Univ. at Raleigh. Dept. of Zoology.
D. W. Stanley, and J. E. Hobbie.
Limnology and Oceanography, Vol 26, No 1, p 30-42, January, 1981. 7 Fig, 2 Tab, 39 Ref. OWRT-B-077-NC(2).

Descriptors: *Nitrogen, *Coastal streams, *Water chemistry, Ammonium, Nitrogen compounds, Dissolved solids, *North Carolina, Rivers, Particulate matter, Cycling nutrients, Path of pollutants, *Chowan River.

An experimental study of nitrogen cycling near the mouth of Chowan River, a Noth Carolina coastal river, was designed to investigate the validity of several assumptions frequently made about this process. The measured (bi-weekly) rates of ammonium assimilation by plankton were compared with

the rates of ammonium input (by runoff) into the system over a year. An estimation of the amount of nitrogen recycling was made from the differences between the assimilation rates and the rate of ammonium input into the system. High wintertime flow rates and concentrations of particulate and dissolved inorganic nitrogen resulted in much higher winter inflows, e.g., 1,127 tons of nitrogen in January, than summer inflows, e.g., 185 tons in August. Dissolved organic nitrogen comprised about 69 percent of the total annual nitrogen inflow, particulate nitrogen comprised 13 percent, and the remaining 18 percent was mostly ammonium. The lower section of the river is responsible for the breakdown of as much as 33 percent of the incoming dissolved organic nitrogen. Assimilation of ammonium by river plankton, computed by the short term uptake of tagged carbon and nitrogen, averaged about 100 grams of carbon per square meter per year and 32 grams of nitrogen per square meter per year. The seasonal patterns of inflow and uptake of dissolved inorganic nitrogen were completely out of phase. Over the period of the whole year, as much as 65 percent of the dissolved inorganic nitrogen assimilated by river plankton may have come from regeneration, mostly of ammonium, within the river. (Carroll-FRC)
W82-02822

MODEL OF TRACE-METAL PARTITIONING IN MARINE SEDIMENTS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
S. M. Oakley, P. O. Nelson, and K. J. Williamson.
Environmental Science and Technology, Vol 15, No 4, p 474-480, April, 1981. 11 Fig, 2 Tab, 41 Ref.
OWRT-A-044-ORE(3), 14-34-0001-9039.

Descriptors: *Trace elements, *Metals, *Sediments, Model studies, Adsorption, Sea water, Humic acids, Clays, Path of pollutants, Bentonite, Manganese oxides, Iron oxides, Copper, Cadmium, Trace metals.

An equilibrium adsorption model was developed to predict the partitioning of trace metals between different geochemical phases in aquatic sediments. The conditional equilibrium constants are determined from linear portions of adsorption isotherms. Partitioning of Cu and Cd was studied using bentonite clay, ferric hydroxide, manganese dioxide and humic acid in sea water, simulating a natural marine environment. Adsorption constants were much higher for Cu than for Cd for all the solid phases: Cu on bentonite clay, 43 liters per g; ferric hydroxide, 205; manganese dioxide, 7,339; and humic acid, 366. Constants for Cd were as follows (liters per g): bentonite clay, 1.1; ferric hydroxide, 4.4; manganese dioxide, 15.0; and humic acid, the lowest, 0.2. Since clay can account for up to 75% of many marine sediments; humic acid, 1.4-1.7%; and manganese dioxide, 0.003%, the model predicts that clay is the major sink for both Cu and Cd using the artificial geochemical phases described. Since the materials used in the laboratory studies were purified, results should not be extrapolated to the more complicated natural environment. (Cassar-FRC)
W82-02824

PLANKTON STUDIES IN SAN FRANCISCO BAY. I. CHLOROPHYLL DISTRIBUTIONS AND HYDROGRAPHIC PROPERTIES OF THE SAN FRANCISCO BAY ESTUARY, JULY 1977 - DECEMBER 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W82-02831

DIEL OXYGEN VARIATIONS IN THE RHODE RIVER ESTUARY, MARYLAND, 1970-1978,
Geological Survey, Edgewater, MD. Water Resources Div.
R. L. Cory, and P. V. Dresler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-225484, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-10, March, 1981. 14 p, 5 Fig, 2 Tab, 22 Ref.

Descriptors: *Dissolved oxygen, *Water quality, *Estuaries, *Rivers, Water temperature, Salinity, Water pollution effects, *Maryland, *Rhode River Estuary, Chesapeake Bay, Diurnal variations.

Since April 1970 the U.S. Geological Survey has operated an estuarine water quality monitor in the upper reach of Rhode River, a small embayment on the northwestern shore of Chesapeake Bay. This report analyzes variations in diel oxygen over the period April 1970 through January 1979. The diel oxygen range is used as an indicator of open-water metabolism. Polygons of temperature versus salinity portray the monthly variations of the two dominant environmental factors which influence biological metabolism and reveal effects of events such as a cool versus a warm spring or salinity reduction due to tropical storm freshwater runoff. Seasonally the average daily oxygen pulse range increased from a winter low of 1.6 mg/L to summer high of 5.3 mg/L. Annually highest daily ranges occurred the summer of 1972 when nutrient laden runoff from tropical storm Agnes stimulated open-water metabolism to produce an average diel range of 6.3 mg/L. Spearman's ranked correlation coefficients were used to compare seasonal and annual variations in temperature and salinity versus diel oxygen range. There was high agreement between annual variations in spring temperatures and diel oxygen ranges and an inverse correlation between summer and autumn salinity and diel oxygen range. (USGS)
W82-02841

METEOROLOGICAL INTERPRETATION OF THE CHEMICAL COMPOSITION OF RAINWATER AT ONE MEASURING SITE,
Utrecht Rijksuniversiteit (Netherlands). Inst. voor Meteorologie en Oceanografie.
For primary bibliographic entry see Field 2K.
W82-02874

VINYL LINED ASBESTOS CEMENT PIPE PROBLEMS, OPERATOR ASPECTS,
Champlain Water District, South Burlington, VT.
R. L. Gardner.
Journal of the New England Water Works Association, Vol 95, No 3, p 220-223, 1981.

Descriptors: *Pipes, *Linings, Drinking water, Water pollution sources, *Carcinogens, *Asbestos, Chemical compounds, Decision making, Public relations, *Vermont, Public rights, Public policy, Public opinion, Trichloroethylene.

A potential problem of TCE (trichloroethylene) leaching out from vinyl linings of asbestos/cement pipes with its potential effect on human health was recognized in the Champlain Water District in April of 1980. A survey of the three water systems (South Burlington, Shelburne and Williston) was requested by the State Health Department of Vermont. Particular attention was to be given to pipe installed after 1974. TCE is listed as a suspected carcinogen; 40 ppb is the recommended maximum exposure over the long term. The maximum TCE level found in drinking water was 14 ppb. While the studies revealed that there was no cause for alarm over the drinking water in this area, the experience brought out two major points to be considered in dealing with a potential crisis in a department which involves public health. These two challenges are dealing with the water user's anxiety for his well being, and maintaining public confidence in the ability of the Department to handle the problem. Two essential means of maintaining control and accountability are described. The first is to call a staff meeting and inform the employees about the nature of the problem and the steps being taken to deal with it. The second item suggested is to remain available and communicative with the press. (Baker-FRC)
W82-02898

THE RELATIVE CONTRIBUTIONS OF SULFURIC AND NITRIC ACIDS IN ACID RAIN TO THE ACIDIFICATION OF THE ECOSYSTEM. IMPLICATIONS FOR CONTROL STRATEGIES,
Domtar Ltd. Research Centre, Senneville (Ontario).
For primary bibliographic entry see Field 5C.
W82-02913

LEACHING OF A SORBED SOLUTE: A MODEL FOR PEAK CONCENTRATION DISPLACEMENT,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
P. W. A. Dayananda, F. P. W. Winteringham, C. W. Rose, and J. Y. Parlange.
Irrigation Science, Vol 1, No 3, p 169-175, 1980. 3 Fig, 1 Tab, 27 Ref.

Descriptors: *Leaching, *Irrigation effects, *Solute transport, *Fate of pollutants, Fertilizers, Soil profiles, Model studies, Raats model, Evapotranspiration, Rainfall infiltration, Infiltration, Absorption.

A simple model is developed for calculating the peak solute concentration depth in the case of a solute applied to the soil surface and subjected to alternating irrigation/rainfall and evaporation. This is compared with the Raats model (1975), which considers the distribution of salts in the root zone when irrigation and evapotranspiration rates are time invariant or change suddenly. Unlike the Raats model, the model presented here includes chemical and biochemical transformations, has no restrictions on evaporation or irrigation history, does not assume a constant water content, and is more readily applied to field situations. However, the Raats model can analyze the whole profile, whereas the present model is limited to predictions of peak movement. Field data on chloride and nitrate ion transport in Wisconsin (Saffigna et al., 1977) were compared with model predictions. The predicted and observed times for solute peak concentrations to reach the bottom of a 150 cm lysimeter after fertilizer application agreed well. (Cassar-FRC).
W82-02922

AN ANALYSIS OF THE FIRST YEAR OF MAP3S RAIN CHEMISTRY MEASUREMENTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W82-02934

KD'S--CAN THEY BE USED TO DESCRIBE REVERSIBLE ION SORPTION REACTIONS IN CONTAMINANT MIGRATION,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. J. Reardon.
Ground Water, Vol 19, No 3, p 279-286, May/June, 1981. 7 Fig, 3 Tab, 10 Ref.

Descriptors: *Distribution coefficient, *Sorption, *Chemical reactions, Ion transport, Fate of pollutants, *Solute transport, Groundwater pollution, Leachates, Model studies, Equilibrium, Chemical precipitation, Radioactive waste disposal, Waste disposal, *Path of pollutants.

A constant charge model for reversible ionic sorption was used to demonstrate that distribution coefficients (Kd) of an ionic species vary in the case of contaminant migration in groundwater systems. In this dynamic situation the sorbed site populations at any point along the flow path are not in equilibrium with the way groundwater will evolve from mineral dissolution/precipitation, redox reactions, and prior sorption reactions during flow when it reaches this point. This work showed that Kd cannot be used to describe reactions in landfill leachate studies or deep well injections of liquid wastes where the chemistry of contaminated water is significantly different from the natural groundwater in the aquifer. It is doubtful that Kd's can be used to study trace element contamination in high level radioactive waste disposal studies because heating at the disposal site can change the chemical reaction rates. (Cassar-FRC)
W82-02942

OXYGEN-CONSUMING ORGANICS IN NONPOINT SOURCE RUNOFF,
Corvallis Environmental Research Lab., OR.
A. R. Abernathy.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205981, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-033, July, 1981. 2 p.

Descriptors: *Nonpoint pollution sources, *Water pollution sources, *Biochemical oxygen demand, *Urban runoff, *Dissolved oxygen, Nutrients, Sediments, Pesticides, Runoff, Fish, Oxygen demand.

A comprehensive survey and review of recent literature, especially EPA Research Reports, relating to nonpoint source (NPS) runoff from both urban and rural sources was carried out. Urban NPS runoff has been shown to contain large quantities of oxygen-demanding materials. Modeling studies have indicated that the dissolved oxygen (DO) demand from urban NPS runoff can result in low DO concentrations, either alone or in combination with point source discharges. The most serious rural NPS pollutants seem to be sediments from soil erosion, plant nutrients, and toxic materials such as pesticides. Continuous exposure to DO concentrations significantly lower than air saturation concentrations seems to be harmful to fish, both salmonids and warmwater species. Exposure to fluctuating DO concentrations between air saturation and 60-65% of saturation can reduce the growth rate of fish if the high and low concentration exposure periods are approximately equal (12 hours each) during each day. Efforts should be made to achieve the appropriate DO standards by reducing the loads of BOD in NPS runoff as well as point source discharges. Reduction of the BOD loadings from NPS runoff should result in other improvements in receiving water quality by reducing the loadings of suspended solids, plant nutrients, and potentially toxic materials. (Moore-SRC)
W82-02966

ORIGIN AND CHEMICAL COMPOSITION OF ANDROSCOGGIN RIVER FOAM,
Jordan (Edward C.) Co., Inc., Portland, ME.
B. K. Wallin, and B. T. Bisson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-208167, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-087, July, 1981. 5 p, 1 Tab.

Descriptors: *Foaming, *Surfactants, *Water pollution effects, *Effluents, Pulp and paper industry, Municipal wastewater, Resins, Fatty acids, Nonpoint pollution sources, Aromatic compounds, Foaming, *Androscoggin River, Maine.

For some time the rivers of northern New England have been known to be prone to foaming. In order for foam to occur, a critical concentration of a surface active substance must be present. A sampling and analysis program on the Androscoggin River and at International Paper Company's Androscoggin Mill in Jay, Maine investigated the origin and chemical composition of foam. Foaming has been an historical problem within pulp, paper, and paperboard mills, due to resin and fatty acids in mill effluent. Publicly owned treatment works and nonpoint sources may also be a source of surfactants. River foam downstream of Topsham was found to contain a plethora of organic matter, including neutrals, weak acids, polyaromatic pulping products, as well as inorganics. Foam upstream of all point sources lacked certain components, such as resin acids and chloroguaiacols, but was also found to be extremely complex. An attempt to mass balance a downstream sample of foam accounts for approximately 50% of both organic and inorganic matter. Municipal treatment plant effluents did not produce collectible quantities of foam when subjected to pneumatic treatment, but most of the pulp, paper, and paperboard mill treatment plant effluent samples did produce foam. Collectible foam was found to be enriched in methylene blue active substances, while polyaromatic pulping products were not concentrated in the foam. It could not be determined whether any of the industrial or municipal point sources acted alone, or in combination with one another and ambient conditions to cause the foaming conditions. (Moore-SRC)
W82-02970

FIELD INVESTIGATION OF CONTAMINANT LOSS FROM CHEMICALLY STABILIZED INDUSTRIAL SLUDGES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-246332, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-163, September, 1981. 6 p, 1 Fig, 2 Tab, 2 Ref. EPA-IAG-D4-0569.

Descriptors: *Groundwater pollution, *Leaching, *Sludge disposal, *Industrial wastes, Metal-finishing wastes, Soil contamination, Heavy metals.

In order to determine the effects of stabilized waste sludges on surrounding soils and groundwater, four sites where stabilized industrial wastes had been disposed were examined. All areas selected for study were in the humid eastern or southern United States where rainfall was sufficient to produce abundant leachate. The sludges had all been fixed using the same proprietary process involved addition of cementitious materials to form a stable, soil-like product. Two of the industrial waste sites contained auto assembly (metal finishing) wastes, one contained electroplating wastes, and the fourth contained refinery sludges. The physical properties of soils under the disposal sites were affected little, if at all, by the disposal operation. At one of the auto assembly waste disposal sites, high background levels of certain groundwater constituents masked any escape of pollutants from the fixed sludge. Elevated levels of chloride, calcium, and sodium were found in groundwater under and down gradient from the second auto assembly waste disposal site. Elevated levels of sulfate and boron were found under and down the groundwater gradient from the electroplating waste site. Elevated levels of sulfite, nitrite, cyanide, phenols, and arsenic were noted in groundwater under and down dip from the disposal area at the refinery site. High levels of soils collected beneath the stabilized wastes suggest that contaminants from the waste could be leaching into the groundwater. (Moore-SRC)
W82-02990

SOURCES OF HALOGENATED HYDROCARBONS IN AN URBAN WATER SUPPLY,
Municipal Environmental Research Lab., Cincinnati, OH.
W. C. Elbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-208191, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-089, July, 1981. 3 p, 3 Tab. R804394.

Descriptors: *Halogenated pesticides, *Halogenated hydrocarbons, *Water pollution, *Drinking water, Chloroform, Effluents, Trihalomethanes, Polychlorinated biphenyls, Chlorination, Stream pollution, Water quality, Water treatment.

One of the major water quality problems is the presence of halogenated organics in water supplies, and the formation of certain halocarbons. The Passaic River in Little Falls, New Jersey, was selected for investigation of the sources and nature of such halocarbons in a highly urbanized watershed. The distribution and concentration of high-boiling and low-boiling halogenated hydrocarbons and halogenated pesticides were determined in the following surveys: general stream; sewage treatment plant effluent; industrial waste treatment plant effluent; and source, finished and delivered drinking water. During summer samplings, chloroform was the predominant purgeable halogenated hydrocarbon observed in the Passaic River and its tributaries. During colder months (all under ice cover), methylene chloride was the predominant halomethane. Dominant pesticides observed were alpha- and beta-BHC, and some polychlorinated biphenyls were frequently detected. Of the chlorophenols, trichlorophenol had the greatest distribution followed by 2,4-dichlorophenol, 2,6-dichlorophenol, tetrachlorophenol, and pentachlorophenol. Trihalomethane concentrations always increased in the water samples after chlorination, and trihalomethane formation potentials in stream samples ranged from 66 to 282 micro g/L total trihalomethanes. (Moore-SRC)
W82-02991

5C. Effects Of Pollution

SPATIAL AND TEMPORAL OVERLAP IN LAKE PHYTOPLANKTON COMMUNITIES,
Ottawa Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W82-02610

CHIRONOMIDAE (DIPTERA) OF BALDWIN LAKE, ILLINOIS, A COOLING RESERVOIR,
Southern Illinois Univ. at Carbondale. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W82-02620

EFFECT OF N-BENZOQUINONE AND OF SOME POLYPHENOLS ON THE MEMBRANE POTENTIAL OF NITELLA SP. MEASURED BY THE OPEN-VACUOLE METHOD,
Irkutsk Univ. (USSR). Biological Research Inst.
M. N. Saksonov, M. S. Apartsin, M. P. Grudinin, and D. I. Stom.
Hydrobiological Journal, Vol 16, No 4, p 72-76, 1980. 3 Fig, 14 Ref.

Descriptors: *Water pollution effects, *Phenols, *Algae, Toxicity, Organic compounds, Membrane processes.

A study was made to compare changes in the membrane potential (MP) of cells of Nitella sp. at the time of cessation of the movement of the protoplasm under the influence of phenolic components of effluents differing in the mechanism of their toxic effect on cells. MP was measured without inserting the microelectrode into the cell by the open-vacuole method. The study revealed that the alteration of MP under the influence of n-benzoquinone, pyrocatechol and resorcinol by the time of cessation of cyclosis was negligible when compared with the initial potential, and that in guaiacol and 2,4-DNP the drop of MP was respectively 130 and 86 mV. On the basis of these findings, cessation of the motion of the protoplasm apparently occurs owing to structural disruption of the hydrophobic environment of the protein of the operator and repression of the latter due to changes in its conformation resulting from the alteration of protein-lipid bonds. Cessation of the motion of the protoplasm is a secondary reaction consequent upon damage to the plasmalemma. The more expressive nature of the MP is to be expected in this case. The cessation of cyclosis and the appreciable drop of MP justify the assumption that the effect of 2,4-DNP is also connected in the given case with a direct influence on the architectonics of the plasmalemma and thus on the state of the operators. The findings show fairly clearly that the reaction of MP and of the motion of the protoplasm to the compounds tested is closely connected with the way in which their toxic effect is exerted on the cells, and must be taken into consideration when devising biological tests. (Baker-FRC)
W82-02626

A CHIRONOMUS TENTANS BIOASSAY FOR TESTING SYNTHETIC FUEL PRODUCTS AND EFFLUENTS, WITH DATA ON ACRIDINE AND QUINOLINE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. M. Cushman, and M. I. McKamey.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 5, p 601-605, May, 1981. 2 Tab, 18 Ref.

Descriptors: *Coal gasification, *Midges, *Toxicity, Water pollution effects, Testing procedures, Bioassay, Industrial wastewater, Acridine, Quinoline, Organic compounds, *Synthetic fuels.

As part of a program to evaluate the environmental effects of synthetic fuel products and effluents,

a series of tests is being used to measure the toxicity of these products and of representative pure compounds to aquatic organisms. A method for toxicity testing of synthetic fuel products and wastewater was developed for the midge, Chironomus tentans. Unlike previous C. tentans bioassays, this procedure excludes effects of organic substrates, feeding, aeration, and light. The midges were tested in glass beakers of filtered well water on a glass wool substrate. Calculated 48 hour LC50 values for typical synthetic fuel products were: acridine, 1.96 mg per liter, and quinoline, 57.2 mg per liter. (Cassar-FRC)
W82-02630

TOXICITY OF ENVIRONMENTAL ACID TO THE RAINBOW TROUT: INTERACTIONS OF WATER HARDNESS, ACID TYPE, AND EXERCISE,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
M. S. Graham, and C. M. Wood.
Canadian Journal of Zoology, Vol 59, No 8, p 1518-1526, August, 1981. 4 Fig, 1 Tab, 47 Ref.

Descriptors: *Water hardness, *Acidic water, *Fish, Water pollution effects, Toxicity, Acid rain, Hydrogen ion concentration, Sulfuric acid, Hydrochloric acid, Trout, Fish behavior.

The effects of water hardness (14 or 140 mg per liter CaCO3), acid type (HCl vs. H2SO4), and activity level (rest vs. exercise) on acid toxicity to rainbow trout fingerlings were studied at 15C in 7-day exposures. The 7-day LC50 pH levels were 4.1-4.5. H2SO4 was less toxic in hard water than in soft water at all pH levels during rest and exercise. Hard water decreased toxicity of HCl at pH less than 3.5 and increased toxicity at pH above 3.8. H2SO4 was less toxic than HCl in hard and soft waters except for soft waters above pH 3.8. Exercise increased H2SO4 toxicity in both hard and soft waters except in soft water at pH < 3.3. Critical swimming speeds were not significantly different between hard and soft water at the same pH in the ranges of 3.5-4.2 and neutral. However, below pH 4.6 in soft water and 4.4 in hard water, critical swimming speeds decreased 4% per 0.1 pH units. Any extrapolation from laboratory toxicity data to field survival criteria should consider the interactions described above. (Cassar-FRC)
W82-02631

EFFECTS OF FINE SEDIMENTS ON GROWTH OF JUVENILE COHO SALMON IN LABORATORY STREAMS,
Corvallis Environmental Research Lab., OR.
M. R. Crouse, C. A. Callahan, K. W. Malueg, and S. E. Dominguez.
Transactions of the American Fisheries Society, Vol 110, No 2, p 281-286, 1981. 5 Fig, 2 Tab, 13 Ref.

Descriptors: *Salmon, *Sediment concentration, Streams, Spawning, Aquatic productivity, Sedimentation, Sediment load, Fish eggs, Particle size, Habitats, Aquatic habitats, Substrates, Stream erosion, Stream degradation, Water pollution effects, *Fish physiology, Fish growth.

Previous studies have shown that sedimentation can affect salmon and trout streams by decreasing embryo survival and by reducing food organisms and habitat for juvenile and adult fish. Production by juvenile coho salmon (Oncorhyncus kisutch) was studies in 12 laboratory streams under six levels of fine sedimentation. Fish production was measured as a product of the mean number of fish in the channel and the difference in their mean initial and mean terminal weights. The production of juvenile coho salmon for each growth period was inversely related to quantities of fine sediment. Since increasing the sedimentation suppressed fish production, it was recommended that the habitats of salmonid juveniles as well as spawning areas should be protected against fine sediments. A visual technique for evaluating stream substrate quality, the Substrate Score, correlated closely with both the geometric mean particle size of the substrate and fish production. This method may also be used in field studies. (Geiger-FRC)
W82-02639

FARM, URBAN DRAINAGE POLLUTING GREAT LAKES.
For primary bibliographic entry see Field 5B.
W82-02647

DECOMPOSITION AND MICROBIAL COLONIZATION OF LEAVES IN A STREAM MODIFIED BY COAL ASH EFFLUENT,
Wisconsin Univ.-Madison. Lab. of Limnology.
A. M. Forbes, and J. J. Magnuson.
Hydrobiologia, Vol 76, No 3, p 263-267, 1980. 3 Fig, 17 Ref.

Descriptors: *Macroinvertebrates, *Leaves, *Decomposition, Coal ash, *Water pollution effects, Invertebrates, Streams, Biodegradation, Degradation, Microbial degradation, Organic matter, Fungi, Aquatic fungi, Aquatic habitats, Food habits.

Leaves of sugar maple (Acer saccharinum) were submerged in a stream contaminated with coal ash effluent and in a reference stream on December 5, 1977. After 96 days immersion the ash-exposed leaves showed little decomposition beyond leaching of soluble organic material. Leaf surface area was almost unchanged, at about 55 sq cm per leaf (control 40 sq cm per leaf); ash free dry weight of a 15 mm disc was 4 mg per disc (control, 3 mg per disc); and ATP content was almost unchanged at about 50 nmol per g (control quadrupled from 100 nmol per g at 27 days to 400 at 96 days). No macroinvertebrates were found in the ash pit drain leaves, but 150 individuals per leaf pack from 19 taxa (predominantly grazers) were present in the control. Ash-exposed leaves were stiff and yellow-brown; control leaves were very thin and dark brown. The effluent stream was 2.7 + over - 1.9C warmer than the control stream and was higher in conductivity and lower in pH. Apparently the ash effluent indirectly reduced the quality of the environment for aquatic macroinvertebrates by inhibiting microbial growth on the leaves. (Cassar-FRC)
W82-02654

AGGREGATION OF SPOTTAIL SHINERS IN THE HEATED DISCHARGE OF A NUCLEAR POWER STATION,
National Marine Fisheries Service, Miami, FL.
E. D. Prince, and L. J. Mengel.
Transactions of the American Fisheries Society, Vol 110, No 2, p 221-225, March, 1981. 2 Fig, 1 Tab, 22 Ref.

Descriptors: *Water pollution effects, *Shiner, *Fish populations, *Nuclear powerplants, *Thermal pollution, Reservoirs, Ecological effects, Population dynamics, Aquatic populations, Population density, Distribution, Thermal water, Heated water, Powerplants, Electric powerplants, Keowee Reservoir, South Carolina.

Fish populations from five shoreline sites of Keowee Reservoir, South Carolina were sampled by bag seine for five consecutive summers from 1973 to 1978 to assess the impact of the Oconee Nuclear electric powerplant on fish distribution and abundance. Spottail shiners (Notropis hudsonius) were significantly more abundant in the waters affected by the heated discharge of the nuclear powerplant than in the other four areas. N. hudsonius first appeared near the nuclear station in 1975, and by 1977 was the most abundant species in this section of the reservoir. Spottail shiners increased annually during the study period in other areas of the reservoir, but their abundance decreased as distance from the powerplant increased. Increases in temperature and macrophyte populations were associated with increased numbers of spottail shiners and were considered to be regulating factors in the population dynamics of this species in Keowee Reservoir. (Geiger-FRC)
W82-02686

DETOXIFICATION OF CHLORINATED SEWAGE EFFLUENT BY DECHLORINATION IN ESTUARINE WATERS,
William and Mary Coll., Gloucester Point, VA. Inst. of Marine Science.
M. H. Roberts, Jr.
Estuaries, Vol 3, No 3, p 184-191, September, 1980. 1 Fig, 3 Tab, 32 Ref.

Descriptors: *Wastewater treatment, *Dechlorination, Chlorination, *Estuarine environment, Water pollution sources, Chlorine, Toxicity, Detoxification, Decontamination, Secondary wastewater treatment, Advanced wastewater treatment, *Water pollution effects, Oysters, Shrimp, Fish, *James River, Virginia.

The dechlorination of chlorinated sewage effluent was studied to demonstrate that such a process would effectively eliminate toxicity attributable to the chlorine produced oxidants (CPO). The design of the study stipulated that the simulated effluent chlorine concentration should be the same as that in an actual plant effluent, 2 mg/l, as occurs at the James River Sewage Treatment Plant. A portion of the chlorinated sewage effluent was dechlorinated with sodium thiosulfate, and the dechlorinated waste was diluted with estuarine water in the same proportions as the clorinated waste. Menidia menidia, Palaemonetes pugio, and Crassostrea virginica were exposed to both the chlorinated and dechlorinated wastewater. Mortalities were noted in M. menidia and P. pugio due to high concentrations of chlorinated effluent, whereas similar concentrations of dechlorinated wastes did not cause mortalities. Mortalities in the chlorinated waste were correlated with chlorine residuals. The chlorinated wastes depressed the shell deposition rate of C. virginica below 50% of controls at all doses. Dechlorinated waste allowed shell deposition greater than 50% of controls. The occurrence of some growth inhibition, however, was noted in C. virginica exposed to dechlorinated waste, which suggests the presence of toxic material other than chlorine in the waste. (Baker-FRC)
W82-02688

RESPONSE OF SUBTROPICAL PHYTOPLANKTON TO POWER PLANT ENTRAINMENT,
Oceanic Inst., Waimanalo, HI.
P. Bienfang, and W. Johnson.
Environmental Pollution Series A, Vol 22, No 3, p 165-178, July, 1980. 3 Fig, 4 Tab, 16 Ref.

Descriptors: *Phytoplankton, *Cooling water, *Thermal stress, *Powerplants, Kahe, *Hawaii, Chlorophyll a, Adenosine triphosphate, Water pollution effects, Thermal pollution, Seawater, Primary productivity, Productivity, Entrainment, Photosynthesis, Biomass, Seasonal variation.

Phytoplankton entrained in the cooling waters of the Kahe, Hawaii, oil-fired power plant showed a temporary 30% decrease in primary productivity. Chlorophyll a and ATP levels were not significantly affected. Organisms were exposed to a 5-6 degrees C increase over the ambient 24-26 degrees C levels during the 4 min transit time. Rapid mixing returned the discharged water to ambient temperature within minutes. Sampling was done at different seasons during a 20-month period. Laboratory tests confirmed the field data and supported the conclusion that no seasonal variation was apparent. Thermal stress, rather than mechanical or pressure stress, was primarily responsible for the observed effects on the phytoplankton. (Cassar-FRC)
W82-02708

TOXICITY OF TEXTILE MILL EFFLUENTS TO FRESHWATER AND ESTUARINE ALGAE, CRUSTACEANS AND FISHES,
Environmental Protection Agency, Gulf Breeze, FL.
G. E. Walsh, L. H. Bahner, and W. B. Horning.
Environmental Pollution (Series A), Vol 21, No 3, p 169-179, March, 1980. 1 Fig, 5 Tab, 8 Ref.

Descriptors: *Textile mill wastes, *Algae, *Crustaceans, *Fish, *Toxicity, Water pollution effects, Effluents, Shrimp, Daphnia, Aquatic life, Invertebrates, Estuarine environment, Shrimp organic compounds, Heavy metals, Metals, Nutrients, Industrial wastes.

Algae and aquatic animals were exposed in the laboratory to secondary effluents from 23 textile

mills. There were wide variations in chemical compositions, but all contained heavy metals, organic chemicals, and nutrients. Algae, particularly Selenastrum capricornutum (freshwater) and Selenastrum costatum (estuarine), were most responsive to all wastes; some effluents were stimulatory at concentrations of less than 1% but inhibitory at concentrations greater than 50%. Overall, 61% of the effluents were toxic to Daphnia pulex, 40% to fathead minnows (Pimephales promelas), and 53% to grass shrimp (Palaemonetes pugio) and sheepshead minnows (Cyprinodon variegatus). There was no obvious relationship between biological effects and the many parameters of effluent quality. Both growth stimulants and toxicants were present in some wastes. The impact of complex wastes on aquatic systems was calculated using the discharge rate and the LC50, EC50, or SC20. Thus Waste X with low SC20 and high discharge rate was judged most toxic of the group. Waste W, with a low SC20 and low discharge rate, had a low potential for adverse effects. (Cassar-FRC)
W82-02710

ALUMINUM TOXICITY TO FISH AS RELATED TO ACID PRECIPITATION AND ADIRONDACK SURFACE WATER QUALITY,
Cornell University, Ithaca, NY.
J. P. Baker.
PhD Thesis, January, 1981. 458 p, 55 Fig, 40 tab, 152 Ref, 2 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-10995.

Descriptors: *Water pollution effects, *Acid rain, Acidity, Aluminum, Water quality, *Fish, Toxicity, Surface water, Seasonal variation, Hydrogen ion concentration, Lakes, Lake fisheries, New York, *Adirondack Mountains.

The Adirondack Region of New York State contains over 2000 lakes. Many of these lakes are experiencing acidification and declines or loss of fish populations. The objective of this investigation was to improve the understanding of effects of acidification of surface waters on Adirondack fish populations. It was found that on the average, aluminum complexed with organic ligand was the dominant aluminum form in the dilute acidified Adirondack surface waters studied. In laboratory bioassays, speciation of aluminum was shown to have a substantial effect on aluminum toxicity to early life history stages of fish. Based upon available field and laboratory data, concentrations of inorganic aluminum and hydrogen ions appear to be important factors determining fish survival in Adirondack surface waters affected by acidification. For the range of pH and aluminum levels, and fish species and life history stages studied, sensitivity to low pH levels decreased with increasing age while sensitivity to elevated inorganic aluminum levels increased with increasing age (through the post-swim-up fry stage). Water quality in Adirondack lakes and streams sampled was temporally highly variable. In general, in streams affected by acidification pH level was at a minimum (and conversely inorganic aluminum level at a maximum) during early phases of snowmelt in the spring and also during long periods of heavy rainfall, often concentrated in the fall season. Temporal water quality fluctuations in lakes were dampened by the larger water volume and longer water retention times within the system. (Sinha-OEIS)
W82-02726

EFFECTS OF HYDROLOGICAL AND BIOLOGICAL VARIABLES ON THE SURVIVAL, GROWTH, AND FOOD UTILIZATION OF ESTUARINE FISHES CAGE-CULTURED IN A HEATED WATER SYSTEM,
Texas A and M University, College Station.
F. V. Jones.
PhD Dissertation, May, 1981. 328 p, 47 Fig, 2 Tab, 154 Ref, 10 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-18271.

Descriptors: *Aquaculture, *Estuarine fisheries, *Heated water, Powerplants, Cooling water, Cooling ponds, Fish, Growth, Survival, Salinity, Temperature effects, Texas.

Estuarine fishes were cultured in cages in the intake area and at four locations in the cooling lake of a power plant near Baytown, Texas from 1 September 1976 through 1 September 1978 to determine the effects of heated water on the dynamics of growth. Evaluation of data was based on eight hydrological variables, survival, growth and food-conversion efficiency of pinfish (Lagodon rhomboides), spot (Leiostomus xanthurus), Atlantic croaker (Micropogonias undulatus), black drum (Pogonias cromis) and striped mullet (Mugil cephalus). Survival of fishes was low in the intake area and increased progressively through the cooling lake. Mortality was related to temperature, handling stress (especially in small fish) and rapid drops in salinity. The most important relationship relating to mortality was the temperature-salinity-size interaction. During winter periods of low temperature when salinity dropped rapidly, mortality rates were greatest; small fish were better able to tolerate stressful conditions than large fish. Percent growth was highest during warm months when fish were small and lowest in the winter. Instantaneous growth rates were correlated to temperature, salinity, feeding rate, size of fish and, to a lesser extent, station location, DO and pH. Mean food conversion efficiently (FCE) was highest when temperatures were high and fish small. (Sinha-OEIS)
W82-02730

THE EFFECTS OF URBANIZATION ON SMALL WATERSHEDS AND GROUNDWATER,
Rochester Univ., NY. Dept. of Geological Sciences.
R. L. Davis.
PhD Dissertation, 1980. 377 p, 80 Fig, 36 Tab, 77 Ref, 5 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-13608.

Descriptors: *Water quality, *Water pollution effects, *Groundwater, *Urbanization, Watersheds, Urban runoff, Flooding, Erosion, Environmental effects, Chlorides, *Penfield, New York.

A study was undertaken in Penfield, New York, to examine the effects that development was having on the small streams and ground water in the town. The ground water quality data collected from Penfield was analyzed by comparing it to data from the 1930's (when the town was not developed), by comparing groups of wells in rural and urban parts of the town, and by comparing wells grouped by their distance to the nearest road. The surface water data was analyzed by grouping watersheds as to their degree of urbanization. In addition seasonal changes in water quality were examined, as were effects of rainfall and snow fall on surface water quality. Substantially elevated levels of chloride ion concentrations were found in both the surface and ground waters of the town. In the surface waters, the increases in concentration were largest in the most urbanized watersheds, however, all watersheds appear to have been affected. In the ground waters the increases were greatest in ground water samples taken at locations close to roads. The implications suggested by the results of the study included the likelihood of a substantial decrease in quality of the town of Webster's water supply, and by extension, decreased water quality for the entire aquifer that supplies it. In addition, deterioration of surface water quality in Penfield and the other towns with streams tributary to Irondequoit Bay is likely to cause continued deterioration of the Bay environment. Strategies for minimizing the changes accompanying development included the use of less de-icing salt and the use of zoning to channel development into those areas whose development would cause the least damage. (Sinha-OEIS)
W82-02738

THE RESPONSE OF THE INVERTEBRATE FAUNA TO ORGANIC POLLUTION IN A WELL OXYGENATED KARST STREAM EXEMPLIFIED BY THE PRADNIK STREAM (SOUTH POLAND),
Polish Academy of Sciences, Krakow. Zaklad Ochrony Przyrody.
E. Dratnal, and K. Kasprzak.
Acta Hydrobiologica, Vol 22, No 3, p 263-278, 1980. 9 Fig, 2 Tab, 6 Ref.

Descriptors: *Karst hydrology, *Organic wastes, *Poland, Decomposing organic matter, Organic carbon, Waste load, Oxygen, Dissolved oxygen, Sedimentation, Sediments, Rivers, Bed load, *Benthic fauna, *Water pollution effects.

Results of three studies made on the benthic invertebrate communities of the Pradnik stream affected by waste waters from a dairy are presented. The three studies were conducted in 1968, 1969 and 1973-74. Samples were taken from the stream above the influx of wastes and below it as well, from the whole stretch of the stream affected by pollution. During 1969 a new waste water treatment plant in the vicinity broke down several times and the effectiveness of effluents disposal was not sufficient. In spite of some common features in the reaction of animals to organic pollution, marked differences also were in that reaction in the particular periods connected mainly with the varying efficiency of the waste treatment plant. Two zones emerged within the polluted section of the stream. The first zone was situated immediately below the influx of organic wastes. This zone was a zone of sedimentation and initial decomposition of organic matter. The bottom resembled a silty habitat, while the decomposition of the organic part caused a decline in oxygen content in the upper layer and its disappearance in the deeper silt layer. The second zone seemed to be a zone of total decomposition of organic matter and drawing of nutrients released into the process of primary production, expressed by the regulation of oxygen conditions and a high primary production yielding intense growth of algae covering stream-bed zones. (Baker-FRC)
W82-02751

STUDIES ON THE PRIMARY PRODUCTION OF THE RIVER SHATT AL-ARAB AT BASRAH, IRAQ,
Universidad de Oriente, Cumana (Venezuela). Inst. of Oceanography.
M. F. Huq, H. A. Al-Saad, and H. A. Hameed.
Hydrobiologia, Vol 77, No 1, p 25-29, 1981. 3 Fig, 2 Tab, 27 Ref.

Descriptors: *Chlorophyll a, *Productivity, *Rivers, Water pollution effects, Shatt al-Arab River, Basrah, *Iraq, Primary productivity, Eutrophication, Wastewater pollution.

Primary production at three stations in the Shatt Al-Arab River near Basrah, Iraq, was investigated from September 1976 to August 1977. Chlorophyll a levels ranged from 0.52 to 3.25 mg per cu meter and peaked in late February and in September-October. The station upstream of the city had the lowest chlorophyll a values, and the mid-city station, the highest. Gross primary production varied from 6.03 to 37.02 mg C per cu meter per hour with a maximum in August and a minimum in winter at all stations. The mid-city station was most productive. Chlorophyll a concentrations and gross primary production were positively correlated. (Cassar-FRC)
W82-02776

STUDIES ON THE ACUTE TOXICITY OF SOME HEAVY METALS TO AN INDIAN FRESHWATER POND SNAIL VIVIPARUS BENGALENSIS L.,
Udaipur Univ. (India). Dept. of Limnology and Fisheries.
P. K. Gupta, B. S. Khangarot, and V. S. Durve.
Archiv fur Hydrobiolgie, Vol 91, No 2, p 259-264, May, 1981. 2 Tab, 19 Ref.

Descriptors: *Snails, *Water pollution effects, *Heavy metals, Copper, Zinc, Chromium, Nickel, *Toxicity, Cadmium, Ponds, Lakes, *India.

The acute toxicity of salts of copper, zinc, chromium, cadmium and nickel to the freshwater pond snail V. bengalensis was investigated. Snails were collected from FatehSagar Lake, Udaipur, and exposed to the salts under laboratory conditions. The heavy metallic ions were ranked according to the results in 96 hr median lethal dose studies as fol-

lows from the most toxic to the least toxic: copper, zinc, chromium, cadmium, and nickel. The acute toxicity of zinc varied greatly with the changing water quality. The deposition of a white precipitate at the bottom along with an increase in pH was noted in the zinc solution after 24 hr of exposure. This has also been noted in similar studies by other researchers. The 96 hr median lethal values for the metallic ions were 0.088 for copper, 2.83 for zinc, 6.27 for chromium, 8.40 for cadmium, and 39.83 for nickel, in ppm. The cadmium solution also showed a white precipitate and a milky appearance. (Baker-FRC)
W82-02789

THE RELATION BETWEEN 'HYDRAULIC STRESS' AND MICRODISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN A LOWLAND RUNNING WATER SYSTEM, THE SCHIERENSEEBROKS (NORTH GERMANY),
Karlsruhe Univ. (Germany, F.R.) Inst. fuer Zoologisches.
B. Statzner.
Archiv fur Hydrobiologie, Vol 91, No 2, p 192-218, May, 1981. 1 Fig, 5 Tab, 67 Ref.

Descriptors: *Population dynamics, *Running waters, Stress, *Benthos, *Macroinvertebrates, Gastropods, Insects, Crustaceans, Flow characteristics, Hydrodynamics, Flow pattern, *Germany.

During a field study on the production ecology of two lowland brooks in North Germany, the sizing of the specimens sampled indicated a relation between specific size distribution and some hydrodynamic factor. The field data collected was then reviewed in relation to hydrodynamic effects. The study was carried out in the Upper and Lower Schierenseebrook, which are situated between three eutrophic lakes near Kiel. Both brooks are relatively short, with lengths of about 400 and 800 meters respectively. During the sampling period from spring of 1974 through autumn of 1975, discharges reached a maximum in winter and minimum from June to October. The substratum was sampled to a depth of about 5 cm. Parallel to each benthic sample the current speed, water depth, and character of the substratum occurring immediately at the sampling place were noted. The study demonstrated that mean size and abundance of benthic macroinvertebrates may be related to both the index of hydraulic stress and the thickness of the laminar sublayer. While the latter parameter is expected to describe the character of the forces acting immediately above the bottom more realistically than the former, both can be regarded as indices for the specific hydraulic stress. The use of hydraulic stress is favored in studies on running waters. (Baker-FRC)
W82-02790

DISTRIBUTION OF CHROMOBACTERIA IN A LOWLAND RIVER,
Surrey Univ., Guildford (England). Dept. of Microbiology.
M. O. Moss, and C. Ryall.
Microbial Ecology, Vol 7, No 2, p 139-149, 1981. 4 Fig, 4 Tab, 19 Ref.

Descriptors: *Rivers, *Bacteria, Silt, Organic matter, Temperature effects, Rainfall, Turbidity, *Wey River, *England.

The numbers of purple pigmented bacteria in the River Wey were estimated by use of a selective medium. Chromobacteria were not isolated from the springs at the source of the river. However, they were found within a short distance, and their numbers generally increased over the first 30 km. While the counts were always on the low side, they generally increased over the winter as opposed to summer. Water temperature and turbidity measurements, along with rainfall, were recorded during the time of sampling. Much of the variability in the counts of chromobacteria was correlated with turbidity. A significant inverse correlation with temperature was noted after turbidity effects were allowed for. These two factors, temperature and turbidity, together accounted for 64.7% of the variation in counts. A significant correlation was also noted with rainfall during the previous four days. Together these three factors accounted for 67.2% of the variability in counts. Samples of silt, soil and storm overflow effluents were studied in an attempt to discover the source of chromobacteria. The soil or silt which contained substantial quantities of organic material also contained the higher values of chromobacteria. (Baker-FRC)
W82-02795

SEASONAL CHANGE IN CILIATE POPULATIONS IN THE BOTTOM SEDIMENT OF A POLLUTED RIVER,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
S. Suehiro, and Y. Tezuka.
Japanese Journal of Limnology, Vol 42, No 1, p 1-7, January, 1981. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Seasonal variation, *Protozoa, *Sediments, Bacteria, Temperature effects, Light intensity, Bottom sediments, *Water pollution effects, Rivers, Municipal wastewater, *Tamagawa River, *Japan, Population dynamics.

Species composition and the number of individuals of each species of ciliates were investigated for two years in the bottom sediment of a river polluted with municipal sewage. Emphasis was placed on the seasonal change in ciliates, because the seasonal change in river environment was felt to facilitate the study of the relationship between the ciliate community and environmental factors. The study was conducted 2 km upstream from the Marukobaski Bridge of the Tamagawa River, in the southwest part of Tokyo Metropolitan Prefecture, which has been polluted with a large amount of municipal sewage. A similar pattern of the seasonal change in ciliate populations was noted for two years. In winter, Paramecium caudatum, P. trichium, Colpidium colpoda and Chilodonella cucullulus dominated. From summer to autumn Loxodes spp. and P. caudatum were predominant. Frontinia leucas also appeared in the summer. Stentor, Metopus es, Litonotus and Acineria did not change seasonally. A bacterial density of approximately 10 to the 8th power cells per ml was observed in the sediment; thus prey availability does not account for the observed fluctuations. Interspecific relations such as predation and competition may be important factors controlling the seasonal changes in ciliate populations. (Baker-FRC)
W82-02797

BACTERICIDAL EFFECT OF SEAWATER CONTAINING DIGESTED NIGHT SOIL AND MARINE PLANKTON AGAINST INTESTINAL BACTERIA, (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W82-02799

A REEXAMINATION OF THE ZOOPLANKTON COMMUNITY OF A DELAWARE TIDAL STREAM,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5B.
W82-02805

FUNCTIONAL RELATIONSHIPS BETWEEN NUTRIENT DYNAMICS, OXIDATION-REDUCTION CAPACITY, AND EUTROPHICATION IN A SOFT-WATER LAKE,
Connecticut Univ., Storrs. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W82-02810

PHYSICAL CHARACTERIZATION OF EXTRACHROMOSOMAL DNA IN CHESAPEAKE BAY BACTERIA FROM POLLUTED AND NON-POLLUTED SITES,
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W82-02814

PLANKTON STUDIES IN SAN FRANCISCO BAY. II. PHYTOPLANKTON ABUNDANCE AND SPECIES COMPOSITION, JULY 1977 - DECEMBER 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W82-02832

POLLUTION EFFECTS ON THE PHYTOPLANKTON-ZOOPLANKTON RELATIONSHIPS IN AN INSHORE ENVIRONMENT,
Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, and L. Ignatiades.
Hydrobiologia, Vol 75, No 3, p 259-266, 1980. 4 Fig, 4 Tab, 22 Ref.

Descriptors: *Plankton, *Population dynamics, *Eutrophication, Water pollution effects, Coastal waters, Phytoplankton, Zooplankton, Bays, *Aegean Sea.

Water samples were collected from sites in the Aegean Sea area at about 1 meter depth between 10 and 11 AM at two week intervals from July 1977 through June 1978. The seasonal variation of phytoplankton at a station, where the effects of eutrophication from sewage were minimal, was similar in periodicity to the corresponding cycle in lower Saronicos Gulf, with characteristic peaks in spring and autumn. At a second station, where sharp eutrophication conditions prevailed, the annual cycle showed some discrepancies in periodicity, having maximum growth in August. The species the first station diversity at this station was also depressed. The zooplankton annual cycle at the first station was characterized by a period of lower abundance in May-October, followed by an increase in population from November through April, with characteristic peaks in November and March. At the second station the zooplankton cycle showed remarkable changes in periodicity, since maximum abundance occurred in July-September, followed by consequent decreases and increases in the population size during the rest of the year. The quantitative relationship between the principal grazers in the zooplankton population and the phytoplankton dominant species upon which these copepods were believed to graze was tested, but the correlation coefficient was nonsignificant, indicating that the grazers did not feed exclusively on the dominant flagellate. (Baker-FRC)
W82-02886

OBSERVATIONS ON SOME COMMON PARASITES OF BAGRUS DOCMAC FORSKAHL (PISCES: SILUROIDEA) OF LAKE VICTORIA,
East African Freshwater Fisheries Research Organization, Jinja (Uganda).
For primary bibliographic entry see Field 2H.
W82-02887

MORPHOLOGICAL CHANGES IN TOXIC AND NON-TOXIC MICROCYSTIS ISOLATES AT DIFFERENT IRRADIANCE LEVELS,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany.
G. H. J. Kruger, J. N. Eloff, and J. A. Pretorius.
Journal of Phycology, Vol 17, No 1, p 52-56, March, 1981. 4 Fig, 2 Tab, 28 Ref.

Descriptors: *Algae, *Morphology, *Light intensity, Pollutant identification, Phytoplankton, Cyanophyta, Eutrophication, Plant morphology, Microsystis.

Light intensity (4.5-40.0 microEin per sq meter per sec) and culture age produced variations in cell size in 2 isolates of Microcystis aeruginosa, one nontoxic (probably forma flos-aquae) and one toxic (probably forma aeruginosa). Average cell volumes were 33-119 cu microns and 21-74 cu microns, respectively. The rate of cell volume increase in cu microns per day was expressed by 1.03 times light intensity minus 6.49. Highest maximum average cell volume was at 17 micro Ein per sq meter per sec, above which cell growth was disrupted. Cell diameters ranged widely, from 3.4 to

7.2 microns for the nontoxic isolate and 1.8 to 6.4 microns for the toxic isolate. These results show that cell size as a method of distinguishing between the 2 isolates is not reliable unless environmental conditions are carefully considered. (Cassar-FRC)
W82-02906

FACTORS INFLUENCING THE COMPOSITION, STRUCTURE AND DENSITY OF A POPULATION OF BENTHIC INVERTEBRATES,
Alberta Environmental Center, Vegreville.
For primary bibliographic entry see Field 2H.
W82-02909

A CARLSON-TYPE TROPHIC STATE INDEX FOR NITROGEN IN FLORIDA LAKES,
California Univ., Los Angeles. Office of Environmental Science and Engineering.
C. R. Kratzer, and P. L. Brezonik.
Water Resources Bulletin, Vol 17, No 4, p 713-715, August, 1981. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Nitrogen, *Lakes, Trophic level, *Eutrophication, Water quality, Monitoring, Mathematical studies.

A trophic state index was developed based on total nitrogen concentration. Information for building the index was taken from a data base consisting of predominantly nitrogen limited Florida lakes studied in the National Eutrophication Survey. The new index was compared with Carlson's index of 1977, which was based on total phosphorus concentration, and the lesser of the two values for each lake was averaged with indices based on Secchi disk transparency and chlorophyll a concentration to assess the trophic state of the 40 Florida lakes mentioned in the National Eutrophication Survey. Trophic state is a multidimensional phenomenon, and it is agreed in general that no single trophic indicator adequately measures the underlying concept. Combining the major physical, chemical, and biological expressions of trophic state into a single index smooths out the variability associated with individual indicators and provides a reasonable composite measure of trophic conditions in a lake. (Baker-FRC)
W82-02911

THE RELATIVE CONTRIBUTIONS OF SULFURIC AND NITRIC ACIDS IN ACID RAIN TO THE ACIDIFICATION OF THE ECOSYSTEM. IMPLICATIONS FOR CONTROL STRATEGIES,
Domtar Ltd. Research Centre, Senneville (Ontario).
R. A. N. McLean.
Journal of the Air Pollution Control Association, Vol 31, No 11, p 1184-1187, November, 1981. 1 Tab, 34 Ref.

Descriptors: *Acid rain, *Sulfuric acid, *Nitric acid, Snowmelt, Thaw, Aquatic life, Sulfur dioxide, Water pollution sources.

It is proposed that the contributions of nitric acid and sulfuric acid in atmospheric deposition to the acidification of the terrestrial and aquatic escosystems are not equivalent and that, except possibly during the spring thaw, nitric acid contributes considerably less to the acidification of the ecosystem. A major part of the assessment of the impact of acid rain on aquatic and terrestrial ecosystems involves the examination, by means of ion budgets, of the fate of each of the ionic constituents in atmospheric deposition in soils, surface waters, and other places. It was concluded that much of the nitric acid in acid rain is decomposed in the soils and waterways, and in the process acid is consumed. Therefore, unlike sulfuric acid in acid rain, nitric acid is not a significant contributor to long term acidification of the environment. Even so, during the spring thaw, in areas which have been heavily impacted by acid rain for a number of years, nitric acid which has concentrated in the snow pack over the winter may cause ecological damage, especially to fish populations. Though there is little doubt that tighter control strategies are needed to diminish the effects of acid rain on remote ecosystems, the existing control strategies, which have put more emphasis on the control of emissions of sulfur oxides than nitrogen oxides, have a reasonable scientific basis given present limited knowledge of their effects on the ecosystem. (Baker-FRC)
W82-02913

AMMONIA VOLATILIZATION IN A HYPERTROPHIC PRAIRIE LAKE,
National Water Research Inst., Burlington (Ontario). Aquatic Ecology Div.
For primary bibliographic entry see Field 2H.
W82-02915

THE EFFECT OF ALPHA-HYDROXYBENZYLMETHANESULFONATE ON PHOTOSYNTHESIS AND EXCRETION OF CHLORELLA AND NATURAL PHYTOPLANKTON IN A LAKE,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
Y. Watanabe.
Archiv fur Hydrobiologie, Vol 91, No 2, p 219-230, May, 1981. 4 Fig, 3 Tab, 16 Ref.

Descriptors: *Aquatic life, *Water pollution effects, Aquatic plants, *Phytoplankton, Chlorella, Chlorophtya, Algae, Lakes, Organic compounds, Stratification, Oxidation, *Hydroxybenzylmethanesulfonate.

The effect of alpha-hydroxybenzylmethanesulfonate on the photosynthesis and excretion of cultured Chlorella ellipsoidea and the natural phytoplankton populations in a lake was investigated to further the understanding of the role of glycolate excretion by phytoplankton in the carbon cycle in an aquatic ecosystem. HBMS stimulated the glycolate excretion of Chlorella in culture under a wide range of temperatures and light intensities. Similar effects were ascertained for the phytoplankton of a stratified eutrophic lake, Lake Nakanuma, in various seasons and at different depths of the photic zone. HBMS did not enhance the excretion of high molecular weight substances. The dark fixation of carbon dioxide by both samples was inhibited by HBMS. Total photosynthesis by Chlorella was slightly enhanced by HBMS. For the phytoplankton samples, the effect of HBMS on total photosynthesis was indefinite. The variability of the effect was apparently influenced by the nutritional state of the phytoplankton cells. (Baker-FRC)
W82-02918

CHANGES IN FLORA DOWN A STREAM SHOWING A ZINC GRADIENT,
Durham Univ. (England). Dept. of Botany.
P. J. Say, and B. A. Whitton.
Hydrobiologia, Vol 76, No 3, p 255-262, 1980. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Zinc, *Mine wastes, *Algae, *Aquatic plants, *Water pollution effects, Water quality, Gillgill Burn, England, Heavy metals, Streams, Species distribution, Diatoms, Cyanophyta, Chlorophyta, Chrysophyta.

The effects of zinc from lead mines abandoned in 1921 on the flora and water chemistry of a small stream were studied. Samples from 30 reaches, each 10 m long, of Gillgill Burn and its four tributaries contained from 0.24 to 25.6 mg per liter Zn (means for any one reach). There was a negative correlation between the number of photosynthetic species in a reach and the logarithm of Zn concentration. A nonpolluted stream contained 61 species, 11 not seen in Zn-contaminated waters. The water with the highest Zn level (25.6 mg per liter) had 25 species. Up to 41 species were recorded in water containing low levels of Zn (1-2 mg per liter). The species composition changed with Zn levels. Some species were present only at higher levels of Zn (less than 3 mg per liter): Schizothrix delicatissima, Synechococcus sp., Eunotia tenella, Pinnularia borealis, and Euglena mutabilis. Others were not observed in polluted waters: Microspora amoena, Synedra ulna, and Tabellaria flocculosa. (Cassar-FRC)
W82-02946

GROWTH CHARACTERISTICS OF THE HETEROTROPHIC BACTERIAL POPULATION OF WATER AND BOTTOM SEDIMENTS IN TANKS UNDER DIFFERENT TROPHIC CONDITIONS,
Kalyani Univ. (India). Dept. of Zoology.
B. B. Jana, G. N. Patel, S. K. Roy, and U. K. De.
Hydrobiologia, Vol 75, No 3, p 231-239, 1980. 2 Fig, 5 Tab, 14 Ref.

Descriptors: *Population dynamics, *Bacteria, *Sediments, Bottom sediments, Nutrients, Trophic level, Eutrophication, Temperature effects, Fertilizers, Microbiological studies, Water pollution effects, Field tests.

The growth characteristics of the heterotrophic bacterial community of water and bottom sediments in field-study tanks were studied under the influence of various doses of inorganic and organic fertilizers. The study was carried out in six cemented tanks of three trophic types in duplicate for twice-normal, normal and zero concentrations of superphosphate, urea and cow manure. Surface water and mud samples were collected at intervals of four hours during a day, once after 7 days and once after 32 days of fertilizer application, in order to determine the generation time of heterotrophic bacteria. The results indicated that the application of single and double doses of fertilizers in these tanks caused distinct changes in the heterotrophic microbial population of water and bottom sediments in the early phase of treatment. Since the organic matter and inorganic nutrients in the double dose tanks had been utilized at a faster rate than the single dose treatment, the population decline was much higher in the former than in the latter treatment for the same passage of time. The population growth of bacteria of water in the tanks was inversely linked with the diurnal changes of water temperature recorded after 32 days of treatment and with dissolved oxygen level. No significant relationship between the heterotrophic bacterial population and the content of water was observed, but an inverse relationship between P and bacterial population in sediment was noted in the early phase of treatment. The growth curve of the heterotrophic bacterial population was independent of the physicochemical processes such as pH, carbonate, bicarbonate, nitrite nitrogen and specific conductivity. (Baker-FRC)
W82-02953

PREDATOR-PREY RELATIONSHIPS AMONG WATER-MITES (HYDRACARINA) AND OTHER FRESHWATER ORGANISMS,
Goeteborg Univ. (Sweden). Dept. of Zoology.
M. O. G. Eriksson, L. Henrikson, and H. G. Oscarson.
Archiv fur Hydrobiologie, Vol 88, No 2, p 146-154, March, 1980. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Ecological effects, *Fish, *Predation, *Population dynamics, *Mites, Aquatic insects, Perch, Oligotrophic lakes, Acidic water, Acidity, Animal populations, Aquatic animals, Water pollution effects, Food chains, Zooplankton, Lakes, Field tests, Parasites, Sweden.

Predator-prey relationships among perch, water-mites (Piona carnea L.) and other aquatic species were investigated in field and laboratory tests. Significant relationships were noted between occurrence of fish and water mites in 16 oligotrophic lakes of Southwest Sweden. In a field experiment that kept perch only on one side of a lake by a net barrier, significantly more water mites were observed in the section containing fish. Laboratory tests showed that mites were eaten by perch only when no other food was available. In lakes devoid of fish, predation from insects kept water-mite populations in check. Water-mite populations may benefit from the presence of fish because increased predation of insects by fish may remove many of the natural predators of water mites. Some other factors such as lake acidification and the presence of more suitable zooplankton prey for water-mites might also account for correlations between fish and mite populations of the same lake. (Geiger-FRC)
W82-02963

OXYGEN-CONSUMING ORGANICS IN NON-POINT SOURCE RUNOFF,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5B.
W82-02966

REDUCTION OF TOXICITY TO AQUATIC ORGANISMS BY INDUSTRIAL WASTEWATER TREATMENT,
EG and G, Bionomics, Wareham, MA.
G. A. Cary, and M. E. Barrows.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-222366, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-043, August, 1981. 5 p, 1 Tab, 3 Ref.

Descriptors: *Toxicity, *Industrial wastewater, *Bioassay, *Effluent, Pesticide industry, Pulp and paper industry, Chemical industry, *Fathead minnows, Daphnia, Aquatic animals, Environmental effects, Wastewater treatment.

In order to biologically evaluate the effectiveness of industrial wastewater facilities in reducing effluent toxicity to aquatic organisms, 24-hour static acute bioassays with untreated influent and treated effluent were conducted using fathead minnows and water fleas. Of primary interest was an evaluation of the capacity of the wastewater treatment facilities of the pesticide industry for reducing toxicity. On-site 24-hour static acute toxicity tests were performed during 10 consecutive workdays at seven industrial sites. Five of the test sites are defined as pesticide manufacturers, while the remaining sites consisted of an organochemical manufacturer and a bleached-kraft papermill. The data from those studies indicate that the wastewater treatment plants provided an average efficiency of 98% in reducing the toxicity of untreated wastewaters. The results of 10 consecutive days of biological testing at each site indicate that the toxicity of the treated effluent samples remained relatively constant from day to day. The average number of lethal units present in the treated effluent, as determined from tests with fathead minnows, was 2.1 with a range of 0-6 lethal units. Water flea tests provide a mean of 6.5 lethal units with a range of 0-34. The toxicity of the untreated influent samples was extremely variable on a day to day basis. Neither species tested proved to be a more sensitive indicator of toxicity, though a larger data base is required to make a valid appraisal. (Moore-SRC)
W82-02971

ALTERATIONS IN THE FREQUENCY OF SISTER CHROMATID EXCHANGES IN FLATFISH FROM PUGET SOUND, WASHINGTON, FOLLOWING EXPERIMENTAL AND NATURAL EXPOSURE TO MUTAGENIC CHEMICALS,
Washington Univ., Seattle. Coll. of Fisheries.
P. T. Stromberg, M. L. Landolt, and R. M. Kocan.
National Oceanic and Atmospheric Administration Technical Memorandum OMPA-10, June, 1981. 50 p, 13 Fig, 8 Tab, 70 Ref.

Descriptors: *Water pollution effects, *Mutagens, *Toxicity, Bioindicators, Fish, Carcinogens, Estuarine environmental, Sublethal effects, Puget Sound, Washington.

Contamination of the aquatic environment by chemical pollutants has become a serious environmental problem which is heightened by the fact that a number of these contaminants have been demonstrated to be mutagenic or carcinogenic. One method that has been used recently to assess the effects of mutagenic chemicals on various organisms measures the rate of sister chromatid exchanges (SCE). The technique of SCE was applied to English sole collected from Puget Sound, Washington. SCE were observed 5.5 days after in vivo exposure to a thymidine analogue, bromodeoxyuridine (50 mg/g body wt) which allows for differentiation in the staining affinity of chromatids and visualization of exchanges between them. A baseline SCE rate of 2.6 exchanges per cell was determined. The sensitivity of this test was examined by subjecting the fish to benzo(a)pyrene (B(a)P). The SCE rates of cells from fish exposed to three concentrations (0.05, 1.5, and 5 micro g/g body wt) of intaperitoneally injected B(a)P were 2.99, 4.07, and 5.93 SCE/cell, respectively. The response was found to be dose-related and significantly higher than the baseline frequency. To test the efficacy of this technique as a useful tool in screening fish for evidence of exposure to mutagenic chemicals, the chromosomes of English sole from a polluted site (Duwamish River, Seattle) were examined and found to have a significantly higher SCE rate (3.25 per cell) than the baseline. (Moore-SRC)
W82-02979

RECREATIONAL WATER QUALITY AND HEALTH,
Illinois Univ. at the Medical Center, Chicago.
R. L. Northrop, G. R. Brenniman, S. H. Rosenberg, R. B. Byington, and C. S. Hesse.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-103599, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-059, September, 1981. 3 p.

Descriptors: *Public health, *Water quality, *Swimming, *Recreation, Water pollution effects, Microbiological studies, Bacteria, Coliforms, Sampling, Beaches, Water analysis.

The overall objective of this pilot study was to develop and evaluate methods to determine the effect of recreational water quality on the health of persons bathing in fresh waters. Two beaches in the Cleveland, Ohio metropolitan area on Lake Erie were chosen for study: Edgewater Beach, near two sources of pollution; and Headlands State Park Beach, with no known point sources of pollution. One hundred families from each beach were selected to participate in the study over three weekends in July 1977. Five water samples were collected in a systematic pattern at each beach at 0900, 1200 and 1500 hours on each test day. Each sample was analyzed for total coliforms, fecal coliforms, E. coli, fecal streptococci, Pseudomonas aeruginosa, total staphylococci, pH, chloride, BOD5, turbidity, specific conductivity, suspended solids, total solids, and temperature. Results indicate that it is possible to recruit and follow families via telephone interviews over a three-week period with low attrition rates. The demographic characteristics of bathers and nonbathers at the two study beaches were generally similar. Families at the beach with poor water quality had a slightly lower socioeconomic status than families at the beach having good water quality. The concentrations of the water variables were found to be significantly different depending on the time of day and day of weekend that they were collected. Quality of recreational water can be adequately monitored by sampling the water for microbiological variables at one central location in the bathing area instead of the five locations used in this study, as long as time of day and day of weekend are considered. (Moore-SRC)
W82-02997

5D. Waste Treatment Processes

SPIRAL CLASSIFIERS HELP ONE MANUFACTURER MEET ENVIRONMENTAL STANDARDS MORE EASILY,
T. Bhagat.
Water and Pollution Control, Vol 118, No 7, p 15, 1980. 1 Fig.

Descriptors: *Industrial wastewater, *Wastewater treatment, Suspended solids, Abrasion, Solids, Settleable solids, Sedimentation, Separation techniques.

Wastewater from the General Motors facility at St. Catharines, Ontario, is treated by the plant's wastewater treatment facility, which handles more than 17,000,000 gallons a day, excluding sanitary waste. The solids content is high in grit and abrasive material, amounting to about 27% sand and iron filings. Severe wear and stoppages were occurring at the plant due to grit in the system. Several methods of cleaning the wastewater before it entered the two 130 ft diameter clarifiers were considered. The solution selected involved the installation of three 72 inch diameter spiral classifiers. The spiral classifier combines settling out of solids and physical removal of larger material. It builds a bed beneath its spiral conveyor so that coarser material and tramp items can be raked up and out the top. Pump and equipment maintenance problems have diminished with the use of spiral classifiers, as there are fewer solids to settle. GM is now meeting environmental standards more easily. Downtime at the company has been lessened. Plans are now being made to cover the classifiers with an insulated enlcosure and pass warm air (24 degrees C) over the surfaces to combat winter freeze-up possibilities. (Baker-FRC)
W82-02602

COMBINED FLUE GAS DESULFURIZATION AND WATER TREATMENT IN COAL-FIRED POWER PLANTS,
Environmental Protection Agency, Research Triangle Park, NC. Utilities and Industrial Power Div.
For primary bibliographic entry see Field 3E.
W82-02606

SUBMERGED DEMINERALIZATION SYSTEM TO BE USED TO PROCESS TMI WASTEWATER.
Industrial Water Engineering, Vol 18, No 4, p 12-13, July/August, 1981.

Descriptors: *Radioactive wastes, *Demineralization, Ion exchange, *Wastewater treatment, *Nuclear powerplants, Cooling water, *Three Mile Island.

The submerged demineralization system originated by Chem-Nuclear Systems, Inc., was scheduled to treat highly radioactive wastewater at the Three Mile Island nuclear plant, starting late in 1981. Basic innovations include: (1) silicon-based zeolite ion exchange resins, which can be loaded to 9500 curies without breakthrough, with organic resins for secondary treatment; (2) a leakage containment system to return leaking water to the decontamination operation; (3) remote control of submerged operating equipment using mechanical linkages; (4) underwater cask loading and storage of spent ion exchange material; (5) a reactor coolant system manifold; and (6) a polishing bed to remove remaining trace fission products. (Cassar-FRC)
W82-02621

APPLICATION OF ADSORPTION TO WASTEWATER TREATMENT,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
W. J. Weber, Jr.
Industrial Water Engineering, Vol 18, No 4, p 19-25, July/August, 1981.

Descriptors: *Activated carbon, *Adsorption, *Organic compounds, Benzene, Carbon tetrachloride, Chlorinated hydrocarbons, *Wastewater treatment, Industrial wastewater, Model studies, Reviews.

The use of adsorption, specifically by activated carbon, for pretreatment of industrial wastes for priority pollutant removal is reviewed. Although activated carbon is an effective adsorbent for most of the 114 organic priority pollutants, the capacities and adsorption rates vary significantly among commercial carbons and among pollutants, and are affected by other substances and conditions. Therefore, it is impossible to generalize or extrapolate system design parameters; each situation requires a separate design. Tables list Freundlich adsorption isotherm parameters for selected pollutants and Freundlich isotherm constants for selected pollutants on four granular and four powdered commercial carbons. The Michigan Adsorption Design and Application Model (MADAM) is discussed and illustrated to show the application of modeling techniques to cost-effective and efficient adsorber design. The two representative cases in-

volve rate data in completely mixed batch reactors containing granular activated carbon for carbon tetrachloride and for benzene. (Cassar-FRC)
W82-02622

ESTIMATION OF PRIMARY PRODUCTIVITY FROM DIEL NITRATE UPTAKE MEASUREMENTS OF THE WATER HYACINTH EICHHORNIA CRASSIPES IN AN AQUACULTURE SYSTEM,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
M. D. Hanisak.
Aquaculture, Vol 19, No 1, p 75-86, January, 1980. 1 Fig, 3 Tab, 19 Ref.

Descriptors: *Nitrates, *Aquaculture, Nitrogen, *Tertiary wastewater treatment, Water hyacinth, Macrophytes, Natural waters.

Eleven diel experiments were conducted from January to July 1978 for Eichhornia crassipes. The primary productivity of the water hyacinth was estimated from the nitrate-nitrogen uptake in an aquaculture system using a continuous, automated nutrient analyzer apparatus. Values determined by directly harvesting the biomass agreed with those obtained by this new method. The use of diel nutrient uptake measurements would be a significant improvement for the proper management of aquatic macrophytes in an aquaculture system where measurements based on harvesting methods would be impractical. There were few diel changes in nitrate-nitrogen uptake by Eichhornia, which is beneficial to this species not only in terms of its ecological success in the natural ecosystem, but also in its ability to remove nutrients from tertiary sewage treatment. However, the applicability of this technique for measuring the primary productivity of natural systems is not clear due to potential problems such as reduced ambient nutrient levels, lack of a steady state, not very homogeneous plant population, greater nutrient regeneration, and lack of clearly defined and measurable nutrient inputs and outputs of the system. However, the method would probably be appropriate in circumstances similar to those that permit the use of diurnal oxygen or 'upstream-downstream' methods of measuring productivity. (Baker-FRC)
W82-02635

REVERSE OSMOSIS SEPARATION OF SULFATE, NITRATE, AND AMMONIA FROM MINING EFFLUENTS,
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
M. Malaiyandi, and V. S. Sastri.
Separation Science and Technology, Vol 16, No 4, p 371-376, May, 1981. 3 Tab, 16 Ref.

Descriptors: *Reverse osmosis, *Membranes, *Mine wastes, Iron, Magnesium, Copper, Zinc, Calcium, Nitrates, Sulfates, Ammonia, Water treatment, *Wastewater treatment, Inorganic compounds, Ion exchange, Quirke Lake, Separation techniques, Cellulose acetate, Water reuse, *Demineralization.

Cellulose acetate membranes were used to study the reverse osmosis behavior of several inorganic ions commonly found in mining effluents. The membranes were first characterized with 1425 mg per liter NaCl solution. The percentage separation increased linearly from 100 to 300 psig and reached a maximum at about 300 psig. The maximum separations for several salts were: sodium sulfate, 1034 ppm, 94.1%; magnesium perchlorate, 830 ppm, 94.7%; magnesium chloride, 1010 ppm, 87.1%; magnesium sulfate, 1020 ppm, 88.2%; calcium chloride, 820 ppm, 89.5%; calcium nitrate, 910 ppm, 94.7% and ammonium nitrate, 3470 ppm, 55.0%. A sample of mining effluent from the Quirke Lake operation, subjected to reverse osmosis at 300 psig, reduced levels of Ca, Zn, Fe, Cu, Mg, nitrate, sulfate, and ammonia from 2.6 to 16 fold. Further second stage reverse osmosis treatment produced a water suitable for recycling purposes. (Cassar-FRC)
W82-02640

SEPARATION OF TOXIC ORGANOTIN COMPOUNDS FROM AQUEOUS SOLUTION BY ADSORPTION,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
D. Bhattacharyya, C. Adema, and D. Jackson.
Separation Science and Technology, Vol 16, No 5, p 495-503, 1981. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Wastewater treatment, *Organic compounds, *Activated carbon, Adsorbents, *Separation techniques, Organic pesticides, Fungicides, Tin, *Adsorption, Carbon filters, Polymers, Pore size, Toxins, Insecticides.

Organotin compounds are used as insecticides, fungicides, wood preservatives, acid corrosion inhibitors and additives to many products such as antifouling paints. They often appear as contaminants in wastewaters due to the wet blasting of boats during overhaul. The adsorption characteristics of aqueous solutions of tributyltin oxide onto activated carbons, polymeric adsorbents and synthetic carbonaceous substances was studied in a column with the aid of flameless atomic absorption spectrophotometry. The best adsorptive capacities were displayed by OL20X50 and Filtrasorb 300 which both contain a high percentage of macropores. At breakpoint, the adosrptive capacity for this carbon was 0.30 and the capacity at exhaustion with 30 milligrams/liter organotin solution is 0.50. The high capacity of this activated carbon would allow long-term operation without the need of any regeneration. (Geiger-FRC)
W82-02641

WASTEWATER TREATMENT WITH POWDERED ACTIVATED CARBON,
Water Pollution Control Authority, Vernon, CT.
C. Pitkat, and C. Berndt.
Public Works, Vol 112, No 10, p 54-56, October, 1981. 3 Fig.

Descriptors: *Wastewater treatment, *Solids, *Chlorination, *Carbon, *Sludge, Suspended solids, *Activated carbon, Aeration, Activated sludge, Biomass, Effluent standards, Digested sludge, Slurries, Sludge filters, Biochemical oxygen demand, Vernon, Connecticut.

Wastewater treatment using powdered activated carbon and a wet air oxidation process for carbon regeneration has met with success in Vernon, Connecticut. The treatment facility receives both domestic and industrial wastes. Wastes from a synthetic textiles plant contain dyes and chemicals which produce high color, BOD and COD levels. The carbon regeneration unit has demonstrated autogenous operation, requiring no outside fuel or heat source once up to operation temperatures of over 400 degrees. Simultaneously with carbon regeneration, the wet oxidation unit has reduced the associated biological solids to a small amount of inert ash, disposable by landfilling. The wet oxidation unit has successfully regenerated spent carbon slurry, and carbon recoveries for the regeneration system have averaged greater than 95 percent. (Titus-FRC)
W82-02642

TREATMENT PLANT FEATURES ULTRAVIOLET DISINFECTION,
C. F. Guarino, and W. C. Wren.
Public Works, Vol 112, No 10, p 82-83, October, 1981. 2 Fig.

Descriptors: *Wastewater treatment, *Disinfection, *Ultraviolet radiation, Solids, *Biodegradation, Anaerobic digestion, Solar energy, Peak flow, Seasonal variation, Discharge, Hydraulics, Design criteria, *Wastewater facilities, Pella, Iowa.

The design of a wastewater treatment plant soon to be installed in Pella, Iowa, is described. It uses solar energy to aid in anaerobic digestion and features one of the first full-scale wastewater disinfection systems using ultraviolet light. Each ultraviolet lamp and jacket is made of high grade natural quartz that allows a minimum 95 percent transmission of 2537 angstrom wave length light through the wastewater. Lamps are rated for 7500 hours of life with an output of 40 watts at the germicidal frequency. Safety, avoidance of generation of toxic byproducts, virus inactivation and space requirements were important considerations in selecting the design. (Titus-FRC)
W82-02644

LAND APPLICATION OF WASTEWATERS: AN OVERVIEW.
For primary bibliographic entry see Field 3C.
W82-02650

ADSORPTION ON CARBON: THEORETICAL CONSIDERATIONS,
S. Miller.
Environmental Science and Technology, Vol 14, No 8, p 910-914, August, 1980. 1 Fig, 2 Tab, 1 Ref.

Descriptors: *Adsorption, *Carbon, Reviews, Theoretical analysis, Pollution control, *Activated carbon, Water treatment, *Wastewater treatment, Mathematical equations.

The scientific basis for various theories and models concerned with the removal of organic solutes from dilute aqueous solution on granular activated carbon is discussed. The equilibrium and dynamic aspects of adsorption, the variables affecting adsorption, and the best-known adsorption models for single- and multicomponent systems are presented in detail. Characteristics of activated carbon are also reviewed. (Baker-FRC)
W82-02658

UPGRADING WITH ROTATING BIOLOGICAL CONTRACTORS FOR AMMONIA NITROGEN REMOVAL,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
C. P. C. Poon, H. K. Chin, E. D. Smith, and W. J. Mikucki.
Journal of the Water Pollution Control Federation, Vol 53, No 7, p 1158-1165, July, 1981. 4 Fig, 17 Ref.

Descriptors: *Biological treatment, *Ammonia, *Effluents, Trickling filters, *Wastewater treatment, Water quality standards, Nitrogen, Nitrification, *Nitrogen removal.

A pilot plant was used to evaluate the utility of a rotating biological contractor process in upgrading a trickling filter system for biochemical oxygen demand reduction and nitrification. The rotating biological contactor system was designed to treat substandard trickling filter effluent. The pilot plant consisted mainly of a 0.5 cm-diameter, four-stage RBC module and a 0.51 m-diameter clarifier. The unit rate of NH3-N removal was low compared to the same RBC process used specifically for NH3-N removal and followed a logistic-S curve or second-order kinetics. The biofilm on the rotating media was very thin, thus a high-density media should be used. Average sludge retention time was 19.8 days, and 0.31 g MLSS/g soluble BOD5 was removed. Nitrification rather than BOD removal controlled the size of the unit selected for application. (Small-FRC)
W82-02673

INFILTRATION/INFLOW SOURCE IDENTIFICATION BY COMPREHENSIVE FLOW MONITORING,
Montgomery (James M.) Inc., Walnut Creek, VA.
D. C. W. DeCoite, R. A. Tsugita, and R. Petroff.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1620-1626, November, 1981. 7 Fig, 4 Tab.

Descriptors: *Sewer infiltration, *Flow measurement, *Monitoring, Infiltration, Rainfall, Computers, Rainfall infiltration, Sewers, Massachusetts, *Sewer systems.

Procedures are presented for the comprehensive flow monitoring program for the Fairfield-Suisun District's (California) sewer system evaluation survey. The flow monitoring program was designed to accurately measure wastewater flows

before, during, and after a significant rainfall event. Areas of significant infiltration/inflow were to be further isolated by smoke testing and television inspection. A computerized flow monitoring program was utilized which was capable of providing synchronized flow readings every 15 minutes within a 15% range of accuracy. The program identified excessive and nonexcessive infiltration/inflow areas, and non-critical areas were quickly eliminated from investigation. Potential savings included reduced costs for smoke testing and television testing programs. (Small-FRC)
W82-02674

RECOMMENDATIONS FOR REGULATORY MODIFICATIONS: THE USE OF WASTE STABILIZATION POND SYSTEMS,
Texas Univ. at Austin. Engineering Department. Dept. of Engineering.
E. F. Gloyna, and L. F. Tischler.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1559-1563, November, 1981.

Descriptors: *Stabilization ponds, *Algae, *Organic carbon, *Wastewater treatment, *Biochemical oxygen demand, Performance evaluation, Water pollution control.

A position on the regulation of waste stabilization pond systems, including limitations on suspended solids, is presented. The position was developed through the evaluation of existing waste stabilization pond systems, the comparison of waste stabilization systems with exemplary activated sludge systems, and studies of algal metabolism as it relates to teceiving waters. A study of four stabilization ponds in Texas indicated that the highest long-term average effluent total BOD5 was 25 mg/liter, and more than 83% of the influent total organic carbon was removed. Waste stabilization ponds were found to remove essentially all priority pollutants and were as effective as high-rate systems. Algal cells in the effluent from properly designed and operated stabilization pond systems did not significantly impact receiving waters. (Small-FRC)
W82-02675

STOCHASTIC MODELING OF AN INDUSTRIAL ACTIVATED SLUDGE PROCESS,
Vanderbilt Univ., Nashville, TN. Dept. of Chemical Engineering.
K. A. Debelak, and C. A. Sims.
Water Research, Vol 15, No 10, p 1173-1183, October, 1981. 14 Fig, 7 Tab, 22 Ref.

Descriptors: *Stochastic process, *Activated sludge process, Mathematical studies, Probabilistic process, Model studies, *Wastewater treatment, Water treatment facilities, Industrial wastes, Biological oxygen demand, Chemical oxygen demand, Oxygen demand.

A Box-Jenkins time series transfer function model was developed for the effluent chemical oxygen demand (COD) using the influent COD, from a sewage treatment process. The data for the study came from an industrial waste treatment plant. The COD data are reported on a daily basis and cover a 14 month period. Typical plant operating conditions are as follows: influent flow, 1.8 GPM; recycle flow, 1.4 GPM; food to microorganisms ratio (loading factor) BOD, 0.15/day, COD, 0.34/day; dissolved oxygen, 3.3 mg/liter; mixed liquor total suspended solids 4600 mg/liter; volatile suspended solids 2850 mg/liter; recycle total suspended solids 18,300 mg/liter; volatile suspended solids 10,300 mg/liter. The outcome of this study and the reanalysis of Berthouex's results in light of the Akaike information criterion (AIC) seem to indicate that a transfer function model based on influent and effluent BOD or COD data alone is not sufficient to accurately predict the behavior of activated sludge plants. While improvement in the prediction of the outputs was achieved with a single difference model even though the two studies were performed on plants with highly different characteristics, it may be possible to improve the outcome still further by including other parameters such as flow, loading, or temperature as inputs to a transfer function model which would improve the model performance. The Box-Jenkins techniques to study the dynamics of activated sludge is useful in determining whether a plant exhibits process instabilities and could benefit from automatic process control. The plant studied here does not fall into that category. (Baker-FRC)
W82-02683

METHODS FOR EVALUATING PERFORMANCE OF FILTER MEDIA,
Metcalf and Eddy, Inc., Boston, MA.
S. L. Bishop.
Water/Engineering and Management, Vol. 128, No 2, p 64, February, 1981.

Descriptors: *Filter media, *Evaluation, Filtration, Separation techniques, Turbidity, Testing procedures, Water treatment, Silt, Head loss, *Performance evaluation.

Various techniques exist for evaluating the performance of a given filter media. These include use of turbidity as a method for evaluating performance and use of microscopic counts as a supplemental procedure to determine the suspended solids passing through the filter and not picked up as turbidity. Head loss data are also useful, since head loss results as a function of the rate of flow and the solids contained in the water. Thus it is an excellent means of determining the responsiveness of the media for a particular water quality. Another process is the net unit production determination. Yet another involves the determination of the silt density index developed for the reverse osmosis process to determine the magnitude of the solids contained in the feed water to the desalting process. (Baker-FRC)
W82-02684

DETOXIFICATION OF CHLORINATED SEWAGE EFFLUENT BY DECHLORINATION IN ESTUARINE WATERS,
William and Mary Coll., Gloucester Point, VA. Inst. of Marine Science.
For primary bibliographic entry see Field 5C.
W82-02688

COMPARATIVE PERFORMANCE OF SYNTHETIC ADSORBENTS AND ACTIVATED CARBON FOR SPECIFIC COMPOUND REMOVAL FROM WASTEWATERS,
Michigan Univ., Ann Arbor.
B. M. van Vliet, and W. J. Weber, Jr.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1585-1598, November, 1981. 8 Fig, 5 Tab, 7 Ref.

Descriptors: *Activated carbon, *Adsorbents, *p-Toluene sulfonate, *p-Chlorophenol, *Wastewater treatment, Performance evaluation, Pollutants, Organic compounds.

The performance characteristics of a selection of eight synthetic adsorbents and two activated carbons were compared with respect to removal of an array of organic compounds. The compounds were: p-toluenesulfonate, p-chlorophenol, dodecylbenesulfonate, phenol, lindane, and carbon tetrachloride. When the equilibria and dynamics of adsorption of p-toluenesulfonate and p-chlorophenol were evaluated for the ten substances, significant differences were found. The carbons generally performed best, followed by the carbonaceous adsorbents and the polymeric and resinous adsorbents. Intraparticle transport dynamics differed widely. The carbonaceous adsorbents exhibited the lowest intraparticle diffusivities, and the macroporous polymeric and resinous adsorbents demonstrated the highest values. (Small-FRC)
W82-02702

TRACE METAL CONCENTRATIONS IN OXIDATION PONDS,
Ecological Analysts, Inc., Oak Ridge, TN.
J. S. Suffern, C. M. Fitzgerald, and A. T. Szluha.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1599-1608, November, 1981. 1 Fig, 9 Tab, 44 Ref.

Descriptors: *Heavy metals, *Tilapia, *Oxidation ponds, Food, Fish, Bioaccumulation, Trace metals, Cadmium, Copper, Zinc, Lead, Nickel, Chromium.

The levels of the heavy metals cadmium, chromium, copper, nickel, lead, and zinc in the muscle and liver tissues of tilapia grown in wastewater oxidation ponds were determined. Also, the heavy metal concentrations of the wastewater, sludge, and other biotic components of the system were determined. Metal levels in the wastewater were lower than those found in most secondary effluents, and concentrations in the biotic components of the system indicated minimal metal accumulation. The tilapia grown in the ponds did not accumulate heavy metals, and concentrations observed were below levels set for foodstuffs. Thus, heavy metals may not be a limiting factor in the use of wastewater as a nutrient when growing tilapia for human consumption. (Small-FRC)
W82-02703

COMBINED EFFECTS OF CADMIUM AND NICKEL ON ACTIVATED SLUDGE PROCESS,
Virginia State Health Dept., Richmond.
M. M. Bagby, and J. H. Sherrard.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1609-1619, November, 1981. 9 Fig, 1 Tab, 44 Ref.

Descriptors: *Cadmium, *Nickel, *Activated sludge process, Heavy metals, Biological wastewater treatment, Chemical oxygen demand.

The effects of heavy metals on biological wastewater treatment were determined in this study of the combined effect of cadmium and nickel on the performance of bench-scale, continuous flow activated sludge units. At given influent COD concentrations, higher concentrations of cadmium and nickel resulted in decreased COD removal efficiency at a given mean cell residence time. COD removal efficiency decreased as the ratio of total influent metal concentration to total system suspended solids increased. The toxic effects of heavy metals were stronger on nitrifying organisms than on heterotrophic organisms. Thus, heavy metals can cause reduced system efficiency under some conditions. (Small-FRC)
W82-02704

REDUCED ENERGY USAGE WITH BIOLOGICAL PHOSPHORUS REMOVAL,
Metcalf and Eddy, Inc., NY.
J. Dedyo, and R. Doan, Jr.
Journal of the Water Pollution Control Federation, Vol 53, No 7, p 1166-1171, July, 1981. 3 Fig, 3 Tab, 1 Ref.

Descriptors: *Biological treatment, *Phosphorus removal, *Costs, Energy, Lime, *Wastewater treatment, Landfills.

The energy-use reductions and resulting cost reductions made possible by replacing a conventional lime post-precipitation phosphorus removal system with a biological phosphorus removal system are discussed. The proprietary process was retrofitted to the existing lime post precipitation phosphorus plant at the Amherst, New York, Water Pollution Control Facility. The plant was about 80% complete, so the flow scheme was revised to incorporate the biological phosphorus removal process with the least possible impact on piping, etc. Two alternatives for handling the lime sludge from the reactor clarifier were examined: recalcining and landfilling. With only minor piping modifications, either alternative would be possible. Energy reductions exceeded 70% for each alternate, with an annual decrease in operating costs of about $958,000 for the recalcining alternative and $1.05 million for the landfill alternative. Thus, the biological phosphorus removal system can be incorporated into an activated sludge treatment system to reduce energy and chemical usage. (Small-FRC)
W82-02705

OBTAINING HIGH-LEVEL WASTEWATER DISINFECTION WITH OZONE,

Oklahoma State Univ., Stillwater. Dept. of Civil Engineering.
E. L. Stover, and R. W. Jarnis.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1637-1647, November, 1981. 10 Fig, 7 Ref.

Descriptors: *Ozonation, *Coliforms, *Disinfection, Ozone, *Wastewater treatment, Performance evaluation, Massachusetts.

Ozone was evaluated as a wastewater disinfectant under stringent bacteriological standards typical of those required of wastewater discharges. The evaluation was conducted at the Marlborough Easterly Wastewater Treatment Plant (Massachusetts), and included process control, reliability, and pretreatment requirements. Over a wide range of operating conditions, good correlation was obtained btweeen total coliform reduction and absorbed ozone dose and between total coliform reduction and effluent total residual oxidants. The log total coliform reduction was a function of the ozone utilized: the more ozone was transferred into the wastewaters, the more bacteria were removed. The amount of absorbed ozone necessary to achieve a certain disinfection level was different for different wastewater qualities. The required ozone dose should be determined experimentally prior to the design of the disinfection system. (Small-FRC)
W82-02706

OPERATION REPORTS: EAST BAY MUNICIPAL DISTRICT (SD NO 1), CALIFORNIA.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1660-1664, November, 1981. 1 Tab.

Descriptors: *Treatment plants, *Operating costs, *Maintenance, Wastewater treatment, Sludge treatment, East Bay Municipal Utility District, California.

An operations report is presented on wastewater treatment at the Special District No. 1 of the East Bay Municipal Utility District, which serves the California cities of Alameda, Berkeley, Emeryville, Oakland, and Piedmont. Activities during the year in the wastewater treatment section included cleaning the vacuum filter-filtrate system of struvite deposits. A major problem developed with the waste sludge thickening centrifuge when the conveyor scroll shaft broke and was out of service for 15 days. The primary sedimentation tanks became overloaded until the unit was rebuilt. Odor monitoring and control programs were carried out, and an energy conservation program reduced power usage by 20%. In the maintenance section, activities included overhauling one of the five 42-in influent pumps and development of new shaft sleeves. The processing unit removed a total of 2750 cu m of grit, sand, and silt, and treated plant flows of up to 636,000 cu m/day. (Small-FRC)
W82-02707

PREVENTION OF PUTREFACTION IN ORGANIC SLUDGE BY CO-PRECIPITATION OF BACTERICIDE AND COAGULANT,
Tokyo Science Univ. (Japan). Faculty of Pharmaceutical Science.
S. Suzuki, and K. Kobayashi.
Environmental Pollution (Series A) Vol 26, No 3, p 187-192, 1981. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Flood processing industry, *Bactericides, *Coagulants, Fermentation, Meat processing industry, *Wastewater treatment, Industrial wastewater, Carbamate pesticides, Sodium dimethyldithiocarbamate, Iron compounds, Sedimentation, Organic matter.

Precipitated organic sludge produced during chemical treatment of fish-meat processing effluent was prevented from generating gas and floating to the surface by the addition of 60 mg per liter sodium dimethyldithiocarbarmate, a bactericide, and ferrous sulfate, a coagulant. Other bactericides tested, in decreasing order of performance in conjunction with ferrous sulfate, were ammonium ethylenebisdithiocarbamate. sodium pentachlorophenol, and 8-hydroxyquinoline. Precipitation decreased with increasing pH from 5 to 9. In fermentation tests sodium dimethyldithiocarbamate and ammonium ethylenebisdithiocarbamate were more effective than the other two bactericides in suppressing gas formation in the sludge. The coagulant ferrous sulfate, ferric sulfate, aluminum sulfate, and polyaluminum chloride were tested with sodium dimethyldithiocarbamate at a 1:1 molar ratio of metal to bactericide. All but the polyaluminum chloride showed precipitation of 90% or higher at neutral pH, indicating that the bactericide can be safely removed from the effluent. Varying the metal: bactericide ratio from 0.5 to 5 showed that over 90% precipitation occurred, even with 1 to 0.5 ratios of metal: bactericide. (Cassar-FRC)
W82-02717

A NEW METHOD OF REGENERATION OF ANION EXCHANGERS USED FOR RECOVERING CHROMATES FROM WASTEWATER,
Maria-Curie Sklodowska Univ., Lublin (Poland). Dept. of Chemical Technology.
L. Pawlowski, B. Klepacka, and R. Zalewski.
Water Research, Vol 15, No 10, p 1153-1156, October, 1981. 6 Fig, 1 Tab,

Descriptors: *Waste recovery, *Chromates, *Wastewater treatment, Recycling, Regeneration, Anion exchange.

A new and economically attractive method for the recovery of water and chromates from wastewater is presented. By cutting off the frontal and tail parts of the regeneration effluent and returning them to the raw wastewater, a significant increase in concentration of the regeneration effluent can be obtained. Not only is this possibility considered, but also the relations between dose of sodium hydroxide used for regeneration, flow rate of sodium hydroxide solution, average concentration of regeneration effluent, recirculation ratio and apparent ion exchange capacity. The application of highly concentrated sodium hydroxide for regeneration of the weakly basic anion exchanger bed resulted in a significant increase in the concentration of the recovered solution of chromates. A further increase in the concentration of the regeneration effluent can be obtained by recycling a certain part of the front and tail regeneration effluent to raw wastewater. However, this recirculation caused a decrease in the effective sodium hydroxide utilization ratio. From the data offered in this report, one can choose the optimal parameters for particular requirements. (Baker-FRC)
W82-02723

STUDIES ON THE ABILITY OF A POTAMOGETON PECTINATUS COMMUNITY TO REMOVE DISSOLVED NITROGEN AND PHOSPHORUS COMPOUNDS FROM LAKE WATER,
Rhodes Univ., Grahamstown (South Africa). Inst. for Freshwater Studies.
For primary bibliographic entry see Field 5B.
W82-02724

PERFORMANCE PREDICTIONS FOR REMOVAL OF TOXIC AND CARCINOGENIC COMPOUNDS FROM WATER SUPPLIES BY ADSORPTION,
Michigan University.
M. Pirbazari.
PhD Dissertation, 1980. 477 p, 171 fig, 33 Tab, 168 Ref, 12 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-29039.

Descriptors: *Water pollution treatment, *Model studies, *Mathematical models, Activated carbon, Adsorbtion, Organic compounds, Polychlorinated biphenyls, *Carcinogens, Pollutants, Trace levels, Dieldrin, Carbon tetrachloride, Benzene.

Treatment with granular activated carbon is a technically and economically viable technology for removal of a broad spectrum of compounds of concern from public water supplies. The efficiency and cost effectiveness of the design and operation of this process, however, are markedly dependent upon optimum utilization of the adsorption capacity of the carbon, consistent with treatment objectives. To accomplish efficiency and cost effectiveness, it is necessary to develop appropriate data regarding system dynamics, and to synthesize the body of this data in such a manner as to render it incorporable in actual plant design and operation. Mathematical modeling and simulation of the dynamics of granular carbon systems can be a particularly effective means for syntheses of data regarding adsorption dynamics, and resultant models can be employed to good advantage in prediction of system performance under a variety of conditions. The research described has focused on development of rate and equilibrium data relative to the adsorption of several representative compounds of natural, industrial, and agricultural origin from water by actived carbon. Further, the Michigan Adsorption Design and Applications Model (MADAM) - which has indicated substantial potential for use in the design and operation of granular carbon systems for wastewater treatment, has been used for simulation and prediction of the dynamic performance of carbon beds for removal of trace quantities of these compounds under conditions approximating those encountered in water treatment practice. (Sinha-OEIS)
W82-02729

OPTIMAL WATER REUSE PLANNING,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6A.
W82-02736

BY-PRODUCT RECOVERY FINANCES TREATMENT,
Unitata Berhad, Teluk Anson (Malaysia).
J. Svensson, P. B. Sorensen, and C. M. Peterson.
Industrial Wastes, Vol 27, No 5, p 22-25, September/October, 1981. 1 Fig, 2 Tab.

Descriptors: *Oil wastes, *Industrial wastewater, *Flotation, Wastewater treatment, Oily water, Aminodan system, Unitata Berhard, *Malaysia, *Palm oil, Flocculation, Byproducts.

The Aminodan system for treating wastewaters containing suspended solids, grease, fat, oils, and proteins converts removed solids into a usable byproduct. The Unitata Berhad plant in Malaysia processes 125,000 tons of palm oil annually, using 29 million gal of process water. The Aminodan system recovers 90% of the solid material, which is converted to acid oil to use in the manufacture of detergents and plastics. Hot, acid effluent is collected in a pit and mixed with cooler water before the dissolved air flotation process, which removes 92% of total fatty matter. Remaining emulsified effluent is clarified with polyelectrolyte and alum flocculation and pumped to anaerobic ponds, where it remains for 5 months until effluent standards are reached. Fatty sludge is deposited in a dump site. In 1980 the company realized a net return of $167,547 over the total operating costs. The system cost $226,160 to install in 1979. (Cassar-FRC)
W82-02756

FIELD REPORT ON A NONPOLLUTING BLEACH PLANT,
Billerud-Uddeholm A. B., Skoghall (Sweden).
H. B. Borjeson, and S. Lindberg.
Tappi, Vol 64, No 10, p 89-93, October, 1981. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Pulp and paper industry, *Bleaching wastes, *Ion exchange, Adsorption, Costs, Kraft mills, Wastewater treatment, Industrial wastewater, *Color removal, Sweden.

A second generation treatment plant for bleached kraft mill effluent went on stream in 1981 at the Billerud works near Lake Vanern, Sweden. Evolved from a 1973 plant in which colored matter was adsorbed on ion exchange columns followed by elution with alkali, the new plant is semicontinuous. The effluent flow is continuous, but the resin is intermittently transferred to separate columns, each designed for a given unit operation. Advantages of the system are adaptability to varying bleaching conditions, more efficient

design, minimum amount of resin needed, and lower cost. Discharges from the plant per ton of pulp are: color, 18 kg Pt; organic chloride, 1.5 kg, inorganic chloride, 76 kg; COD, 34 kg 02; BOD, 10 kg 02, and chlorophenols and chloroguaiacols, 3 g. In most categories there are considerable reductions in pollutants compared with conventional plants. Costs for this pioneering installation are $4.5 million for construction, $650,000-$900,000 for annual operating costs, and $125,000 for maintenance and labor. The annual production of bleached pulp is 100,000 tons. (Cassar-FRC)
W82-02793

A MULTIMEDIA INFORMATION PACKAGE REGARDING LAND APPLICATION OF WASTEWATER AND SLUDGE: A STUDY OF TRAINING DISSEMINATION SPECIALISTS, EVALUATION METHODS, AND COST-EFFECTIVENESS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
L. A. Phillips, R. H. Downing, J. C. Frey, and C. H. Sink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168600, Price codes: A07 in paper copy, A01 in microfiche. Research Project Technical Completion Report, November, 1981. 127 p, 1 Fig, 44 Tab, 5 Ref. OWRT-B-116-PA(4), 14-34-0001-8112.

Descriptors: *Training, Education, Instruction, Wastewater, Sludge, *Wastewater treatment, *Technology transfer, Information dissemination, *Land application, Information package, Cost analysis.

It is not always feasible for a research team to participate in the information dissemination process by attending meetings. This project attempted to provide an alternative means of disseminating information by producing, and evaluating the effectiveness of, a multimedia technology transfer package on land application of wastewater and sludge. The package did not require the scientists to be at the presentation. Video and printed materials were produced and discussion leaders trained. Presentations were made in 14 Pennsylvania communities to 310 registered participants. Evaluations were obtained from 136 participants and 12 discussion leaders. Results indicated that the program reached community decision-makers. Overall reaction was favorable although some participants indicated the program's content was too general. The video method of presentation met with mixed reactions. Some participants indicated a need for 'live' experts on the scene. Presentations that combine the use of video materials with a scientist present would be worth considering. The cost-effectiveness of the LAWWS program was determined by comparing its planning, production and delivery costs with those for a similar program presented live by research scientists. The cost of the LAWWS package was found to be greater for the first 43 presentations. After that, LAWWS was the more economical program. (Fisher-PA)
W82-02815

BRITAIN'S SEWERS - RESEARCHING FOR THE FUTURE,
Water Research Centre Engineering Centre, Swindon (England).
D. Fiddes.
Water Services, Vol 85, No 1026, p 431-432, 435, August, 1981. 2 Fig, 9 Ref.

Descriptors: *Sewer systems, *Maintenance, *Research priorities, Sewers, Rehabilitation, Planning, *United Kingdom.

The objectives of the Water Research Centre's sewerage research program are discussed, and the principal features of the program are described. The program was designed to establish the condition and rate of deterioration of sewers to help develop cost effective strategies for replacement and rehabilitation programs as well as to aid in planning. The program will evaluate renovation techniques and provide guidance and develop methods for the assessment and improvement of the hydraulic performance of sewer systems. Guidance will also be provided in materials, design, and construction of new sewers. The main outstanding technical problem with sewer renovation is that of dealing with drain connections in non-man-entry sewers. (Small-FRC)
W82-02871

TOTNES SEWAGE TREATMENT, RESEWERAGE AND FLOOD PREVENTION SCHEME.
Water Services, Vol 85, No 1026, p 418, 421-422, 424-425, August, 1981. 4 Fig.

Descriptors: *Wastewater facilities, *Flood control, *Activated sludge process, Wastewater treatment, Domestic wastes, Food processing wastes, Stream stabilization, Sludge digestion, Methane, *United Kingdom.

The Totnes sewage treatment works was inadequate and located on a frequently flooded site. The decision was made to build a completely new facility and implement a joint resewerage and flood prevention scheme. The existing foul sewerage system was improved, and major water courses which outfall in culverts throughout the town were culverted and controlled. The new treatment works includes an oxygenated activated sludge plant to treat domestic wastes and wastes from a nearby creamery and pig slaughtering and processing plant. Sludge is treated by anaerobic digestion and dewatering. Methane gas produced during the digestion is used to burn screenings and heat the buildings. The project was begun in 1978, and completion was expected in July 1981. (Small-FRC)
W82-02872

ADVANCED SLUDGE TREATMENT FOR MODERN WATERWORKS,
East Surrey Water Co. (England).
K. Sharp, and J. H. Warden.
Water and Waste Treatment, Vol 23, No 9, p 36, 39, September, 1980. 2 Fig, 5 Ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Sludge thickening, Design criteria, Dewatering, Sludge drying, Sludge solids, Sludge filters, Polymers, Polyelectrolytes, Training, Bough Beach Waterworks, England.

Methods explored by the Bough Beach Waterworks of the East Surrey Water Company to treat, eventually, up to 10 mgd of impounded surface water are examined. Gravity thickening of sludge was introduced to improve treatment of sludge on drying beds. The effectiveness of polymer thickening of several coagulant sludges was demonstrated as long as certain criteria were met. The Water Research Center was asked to design a new sludge treatment plant at Bough Beach that could be built as quickly and as cheaply as possible and be operated within existing manning schedules. The resultant facility can handle about 20 milligrams of sludge solids/liter of raw water treated. A hopper-bottomed sludge tank was used as a balancing tank to buffer batch flows of settled wash water. A single thickener with mechanical backups and two main feed pumps was installed. Sludge pressing was most feasible for sludge dewatering, and a second hopper-bottomed tank can provide storage for up to three days capacity of 125 inch cakes. A flowsheet of the new plant operations is given, and the teamwork used in the training of personnel is discussed. (Geiger-FRC)
W82-02889

BIODEGRADATION OF AROCLOR 1221 TYPE PCBS IN SEWAGE WASTEWATER,
National Water Research Inst., Burlington (Ontario).
D. Liu.
Bulletin of Environmental Contamination and Toxicology, Vol 27, No 5, p 695-703, November, 1981. 5 Fig, 20 Ref.

Descriptors: *Polychlorinated biphenyls, *Biodegradation, Bacteria, *Wastewater treatment, Water treatment facilities, Temperature, Dissolved oxygen, Acidity.

The objective of this study was to assess the biodegradation of commercial PCB formulations in municipal sewage, including the factors affecting the degradation. A selected PCB-degrading bacterium, Pseudomonas sp. 7509, was added as inoculant. The bench scale test of PCB biodegradation was carried out in a 14-liter fermentor equipped with automatic temperature, pH, dissolved oxygen and agitation speed controls. In a typical batch operation, the fermentor was charged with 10 liters of fresh raw sewage which was fortified with 20 ppm each of phosphorus and nitrogen. The temperature was automatically controlled at 20 degrees C, agitation at 400 rpm, and 2 ppm dissolved oxygen in the fermentor broth. Results indicate that Pseudomonas sp. 7509 could oxidize commercial PCB formulations at a rapid rate. If this bacterium is to be considered as a seeding culture for wastewater treatment, it is essential that the bacterium be able to degrade PCBs in the presence of other organic nutrients normally found in wastewater. Since the temperatures of sewage treatment plants in Canada vary considerably with the seasons, it was decided to test the ability of P. sp. 7509 to oxidize PCBs at different temperatures. Even at a temperature as low as 4 degrees C this bacterium was still able to oxidize the Aroclor 1221. The rate of Aroclor 1221 degradation was intimately dependent on the agitation speed of the fermentor's impeller. (Baker-FRC)
W82-02899

TRANSFER OF VOLATILE SUBSTANCES FROM WATER TO THE ATMOSPHERE,
Eidgenoessesche Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 1B.
W82-02902

PREDICTING REACTOR BIOMASS CONCENTRATION IN A FLUIDIZED-BED SYSTEM,
Dorr-Oliver, Inc., Stamford, CT.
W. K. Shieh, P. M. Sutton, and P. Kos.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1574-1584, November, 1981. 9 Fig, 3 Tab, 25 Ref.

Descriptors: *Fluidized bed process, *Mathematical models, *Biomass, Particle size, Particle shape, Mathematical studies, *Wastewater treatment.

A hydraulic model was developed and used to predict the biomass concentration observed during the operation of two fluidized-bed pilot plants. Media size and biofilm thickness are important variables in biomass concentration. The irregularity in particle shape can be accounted for by the volume-equivalent spherical diameter, while the irregularity in particle size can be accounted for by the Sauter mean diameter. Biofilm dry density is a function of biofilm thickness and decreases with increasing biofilm thickness at a given bulk liquid substrate and compared to measured values. Biofilm dry density, biofilm wet density, and the biofilm moisture content were calculated and compared to the values predicted by the model. Relative errors were less than 10%. (Small-FRC)
W82-02932

ENGINEERING RESPONDS TO ECOLOGY,
Whitman and Howard, Inc., Wellesley, MA.
R. E. Hickman.
Water/Engineering and Management, Vol 128, No 10, p 33-34, 36, October, 1981. 3 Fig, 1 Tab.

Descriptors: *Sewer systems, *Construction, Mill River Valley, Environmental engineering, Civil engineering, Engineering, Environmental protection.

A description is offered of the Mill River Valley Sewer Program for Fairfield, Connecticut. The system called for the installation of 35 miles of sewers in an extremely sensitive ecological area. This area included residential neighborhoods with beautifully landscaped lawns, was in a possible national historic site, was near inland and coastal wetlands which were abundant with flora and fauna, and was within a public watershed with

swimming beaches, recreational waterways, and groundwater public well fields. However, the area had suffered for years from inadequate septic systems which gave forth such problems as odors, overflows, and limited household water use. Septic runoff was also seeping into the Mill River and its impoundments, polluting waters used by residents for fishing, swimming, canoeing, and ecological education. The $18,000,000 Mill River Valley Sewer Program brought sewerage service to about 2,000 Fairfield homes and is capable of serving portions of the neighboring town of Easton. The program required close coordination of local commissions, citizen groups, federal and state agencies, and environmental and engineering consultants. The use of town owned land avoided the cost and complications of purchasing private property. The program demonstrated that engineers and environmentalists can work together to economically and practically clean up the environment without sacrificing either technical expertise or ecological concern. (Baker-FRC)
W82-02935

WIND AERATION IN MODEL WASTE TREATMENT SYSTEM,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
C. Polprasert, P. A. Kahn, and N. C. Thanh.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1089-1094, October, 1981. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Aeration, *Wind, *Mixing, *Wastewater treatment, Oxidation, Chemical oxygen demand.

The potential of wind aeration in aerobic wastewater treatment was studied in a laboratory scale oxidation ditch. After deaerating the samples with sodium sulfite and cobalt chloride, an air blower was turned on to stimulate wind up to a velocity of 20 m per sec. Good mixing was obtained in tap water at wind velocities above 15 m per sec. At 20 m per sec the water velocity was 50 cm per sec on the surface and at the 12 and 17 cm depths, and 35 cm per sec at the 7 cm depth. Using mixed liquor suspended solids and wind velocities of 10-20 m per sec, the overall oxygen transfer rate coefficient was 1.2-9.5 per hour, the concentration of mixed liquor suspended solids was 1140-1610 mg per liter, and the oxygen utilization rate was 2-16 mg per liter per hour. COD removal efficiency at a wind velocity of 20 m per sec was tested at residence times of 2-20 days and influent COD concentrations of 280-620 mg per liter. At residence times of 10 days or longer, effluent CODs were less than 20 mg per liter (95% removal). (Cassar-FRC)
W82-02944

DISTRIBUTION OF WASTEWATER IN DRAIN FIELD PIPES,
Cowiconsult, Virum (Denmark).
For primary bibliographic entry see Field 8B.
W82-02945

NEW DEVELOPMENTS IN PAPERMAKING IN WESTERN EUROPE,
Technical Univ. of Denmark, Copenhagen. Inst. fuer Papierfabrikation.
L. Gottsching.
Tappi, Vol 63, No 3, p 50-54, March, 1980. 4 Tab, 38 Ref.

Descriptors: *Industrial wastewater, *Pulp and paper industry, Biological oxygen demand, Oxygen demand, Chemical oxygen demand, Wastewater, Wastewater treatment, *Water pollution control, *Water law, *Europe.

Restrictions regarding environmental pollution, combined with other factors, have caused a slowdown in the economic growth of the paper making industry in Western European countries. National authorities of various countries are imposing increasingly strict regulations concerning effluents. Some mills have to meet individual restrictions depending on the capacity of the recipient, while in other countries the restrictions are the same for all mills or certain groups of mills producing the same paper grades, independent of the capacity of the recipient. In some countries mills must pay a direct or indirect tax or duty to the government for the effluents. In Germany an effluent duty will be introduced during 1981. The duty is calculated from the following parameters: effluent volume, suspended solids, COD, mercury and cadmium contents, and toxicity to fish. The average fresh water input in the German paper industry is about 45 cubic meters per ton of paper. The Schongau paper mill has a specific effluent volume of 8 cubic meters/ton of newsprint despite the fact that it operates a groundwood mill and deinking plants. Separation methods are highly efficient, settled solids are normally fed back into the stock preparation system, and the wastewater emitted to the recipient is clarified mechanically, mostly through sedimentation. (Baker-FRC)
W82-02947

CONTROL OF A PUMPING STATION BY MINI COMPUTER - A PROGRESS REPORT,
Mouchel (L.G.) and Partners, Bath (England).
For primary bibliographic entry see Field 6B.
W82-02956

THE MICROFAUNA OF ACTIVATED SLUDGES. STUDY OF AN OBSERVATION METHOD AND APPLICATION TO MONITOR A PILOT PLANT DURING THE START-UP PHASE. (LA MICROFAUNA DES BOUES ACTIVEES. ETUDE D'UNE METHODE D'OBSERVATION ET APPLICATION AU SUIVI D'UN PILOTE EN PHASE DE DEMARRAGE,
Montpellier-2 Univ. (France). Lab. de Genie Chimique, Traitement et Epuration des Eaux.
C. Drakides.
Water Research, Vol 14, No 9, p 1199-1207, September, 1980. 5 Fig, 6 Tab, 26 Ref.

Descriptors: *Activated sludge, *Fauna, *Microorganisms, *Pilot plants, *France, Population dynamics, Wastewater treatment, Activated sludge process, Species composition.

A method of quantitative observation of the microfauna used for operational monitoring of purification plants was studied. A simple experiment was performed to monitor the start-up of the pilot purification station of the University of Sciences and Engineering of Languedoc, fed with municipal waste water from Montpellier. The density of microfauna was evaluated using a counting chamber technique, and the results correlated with physicochemical factors. The technique was quite reliable when the investigated volume reached 10 mm to the third power. Grouping the microfauna by trophic characteristics made the observation easier without losing too much information. The evolution of microfauna was determined by a set of parameters for which purification yield does not play a major role. The study of the daily evolution of microfauna showed 3 periods: a decrease and disappearance of some species in the first six days, a very unstable period in the next three days, and a more stable period in the next nine days. The set of parameters which do influence the evolution includes recirculation, extraction of sludges, oxygen share and the charge and nature of the effluent. (Hertzoff-FRC)
W82-02960

NONLINEAR PROGRAMMING DESIGN OF WASTEWATER TREATMENT PLANT,
Louvain Univ. (Belgium). Inst. d'Administration et de Gestion.
D. Tyteca, and Y. Smeers.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE4, p 767-779, August, 1981. 1 Tab, 19 Ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Mathematical models, *Mathematical equations, Algorithms, Nonlinear programming, Optimization.

A complete mathematical model has been developed for a wastewater treatment plant comprised of six treatment units, including primary settler, activated sludge reactor, final settler, thickener, anaerobic digester, and vacuum filter. The model includes 43 equations with 51 variables and 12 inequality constraints. A nonlinear programming procedure has been set up for use in studying the optimal design of the plant. This procedure combines the advantages of geometric programming as a general and easy transcription mode for various types of models with the generalized reduced gradient as an efficient algorithm for solving large-scale highly nonlinear problems. The process for transcribing the model as a geometric pattern is demonstrated. A sample situation is used to demonstrate application of the model and the optimization method. Results can be obtained in moderate computer times, significantly reducing the costs associated with conventional design methods. The flexibility and interactivity of this method also allow for easy modification, replacement, or addition of constraints in the model. (Carroll-FRC)
W82-02961

NONLINEAR PROGRAMMING MODEL OF WASTEWATER TREATMENT PLANT,
Louvain Univ. (Belgium). Inst. d'Administration et de Gestion.
D. Tyteca.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE4, p 747-766, August, 1981. 1 Fig, 3 Tab, 40 Ref.

Descriptors: *Mathematical models, *Wastewater facilites, *Mathematical equations, Wastewater treatment, Nonlinear programming, Optimization, Anaerobic digestion, Activated sludge process, Vacuum filtration, Sedimentation, Pollutants, Suspended solids, Dissolved solids, Biomass.

Least cost design studies are intended to result in bringing the total discounted cost of the wastewater treatment plant to the lowest possible level while satisfying a set of constraints relating to effluent quality, performance relationships, and various biological and physical contraints limiting operational ranges of treatment units. This paper presents a complete mathematical model for a wastewater treatment plant which includes six treatment units: a primary settler, an activated sludge reactor, a final settler, a thickener, an anaerobic digester, and a vacuum filter. New equations developed for use in this model include a set of equations which permit description of the distribution of biodegradable materials into suspended and dissolved materials in the aerator and other modifications of classical relationships permitting disaggregation of the global polluting load into biodegradable suspended solids, biodegradable dissolved materials, and biomass. The global model is comprised of 43 equations and 51 variables (and therefore eight degrees of freedom) and 12 inequality constraints. To use the model properly, values must be given to the constants and parameters appearing in the equation. Data from the literature were used for testing this model. (Carroll-FRC)
W82-02962

EVALUATION OF THE FULL-SCALE APPLICATION OF ANAEROBIC SLUDGE DIGESTION AT THE BLUE PLAINS WASTEWATER TREATMENT FACILITY - WASHINGTON, D.C.,
W. Torpey, J. Andrews, and N. Mignone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-219123, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-105, July, 1981. 6 p, 1 Fig, 4 Tab.

Descriptors: *Anaerobic digestion, *Sludge digestion, *Cost analysis, Thermophilic bacteria, Municipal wastewater, Pathogens, Microorganisms, Biodegradation, *District of Columbia.

The mesophilic-thermophilic digestion process is a new two-step concept for treating municipal wastewater sludges. The first step operates under mesophilic process conditions (digestion with anaerobic microorganisms at 90 to 100 F). The

second step operates under thermophilic process conditions (digestion with anaerobic microorganisms that thrive at 120 to 130 F). The existing Blue Plains wastewater treatment plant in Washington, D.C. treats approximately 330 mgd and much of the sludge generated is disposed of without digestion. It has been found possible to process the total waste sludge flow at the Blue Plains plant by adopting the thermophilic anaerobic digestion process to the present digestion facilities. Adoption of the thermophilic option at Blue Plains requires the least capital expenditure, would be the most expedient solution to the sludge management problem, and would yield substantial operational cost savings. It also offers the potential of eliminating the need for composting because of the pathogen kill. A limited expansion of digester capacity is required to handle the entire sludge stream. Digester gas would be available for sale to outside interests after internal heating requirements were satisfied. (Moore-SRC)
W82-02965

EVALUATION OF ION EXCHANGE TECHNOLOGY FOR TOXIC AND NON-CONVENTIONAL POLLUTANT REDUCTION IN BLEACH PLANT EFFLUENTS,
Jordan (Edward C.) Co., Inc., Portland, ME.
J. H. Fitch, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-208175, Price codes: A13 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-086, July, 1981. 6 p, 1 Fig, 3 Tab.

Descriptors: *Pulp and paper industry, *Bleaching wastes, *Ion exchange, *Wastewater treatment, Chlorinated hydrocarbons, Industrial wastewater, Resins, Cost analysis, Zinc, Copper, Cadmium, Nickel, Color removal, Chemical oxygen demand.

A literature review revealed that weakly basic ion exchange resins, based on a phenolformaldehyde matrix, are superior in treating pulp and paper bleach plant effluents. Prior to resin treatment, it is advantageous to adjust the pH and pretreat the wastestream. Screening and filtration remove macromolecular organics, which tend to foul the resin irreversibly. Batch and pilot plant ion exchange installations at Billerud Uddeholm AB in Skoghall, Sweden were evaluated in order to ascertain actual operation parameters and removal efficiencies, as well as associated problems and costs. The batch and pilot scale plants effectively remove color, COD, chlorinated guaiacols and some complexed metals. These treatment plants do not remove resin, fatty acids and phthalates. Inorganic chloride is removed initially but drops off shortly after the cycle starts. Zinc and copper are removed through complexation and chelation processes. Cadmium and nickel appear to be removed effectively in the second column but are virtually untouched in the first. Extended contact time yielded no benefits. Estimated capital cost for installing a full-scale plant to treat bleach plant wastes at a 100,000 metric ton/year plant (Kappa 35) is $4.78 million. Operation and maintenance costs are estimated to be $675,000/year, giving an annual cost (assuming a ten year investment at 10% interest) of about $1.15 million. (Moore-SRC)
W82-02967

REDUCTION OF TOXICITY TO AQUATIC ORGANISMS BY INDUSTRIAL WASTEWATER TREATMENT,
EG and G, Bionomics, Wareham, MA.
For primary bibliographic entry see Field 5C.
W82-02971

PILOT-SCALE ANAEROBIC FILTER TREATMENT OF HEAT TREATMENT LIQUOR,
Hydroscience, Inc., Westwood, NJ.
E. Donovan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-218323, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-114, August, 1981. 5 p, 1 Fig, 4 Tab, 1 Ref.

Descriptors: *Wastewater treatment, *Sludge, *Cost analysis, *Anaerobic digestion, Biological treatment, Anaerobic filters, *Heat treatment, Municipal wastewaters.

The anaerobic filter's capability of removing large amounts of soluble organic matter with no oxygen required, at relatively low hydraulic detention times and low solids production, can result in distinct advantages for the pretreatment of high strength organic wastes. The liquor waste resulting from heat treatment of raw sludge in municipal sewage treatment plants contains high concentrations of soluble wastes, and is often returned to the head end of the plant where it can impose an additional load on the plant's operation and reduce its efficiency. A pilot plant study was conducted on the anaerobic filter treatment of heat treatment liquor. Significant removal of soluble organics from a high strength sludge heat treatment liquor can be achieved at hydraulic retention times of 0.5 to 2 days. The generated gas contained 65% to 70% methane. Based on the pilot column studies, a suggested design and costs for an anaerobic filter unit were developed. These costs were compared with costs of other means of treatment such as the aerobic alternative. The anaerobic filter process had lower capital and operating costs than other modes of treatment. The gas produced would be sufficient to maintain the temperature of the filter at 35 C and provide additional fuel for other uses. These calculations show a net profit in operating costs. (Moore-SRC)
W82-02972

WASTEWATER TREATMENT BY A PROTOTYPE SLOW RATE LAND TREATMENT SYSTEM,
Cold Regions Research and Engineering Lab., Hanover, NH.
T. F. Jenkins, and A. J. Palazzo.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A106 975, Price codes: A04 in paper copy, A01 in microfiche. Army Corps of Engineers CRREL Report 81-14, August, 1981. 52 p, 15 Fig, 26 Tab, 68 Ref.

Descriptors: *Municipal wastewater, *Land disposal, *Wastewater disposal, *Spray irrigation, *Nutrient removal, Forages, Coliforms, Biochemical oxygen demand, Suspended solids, Organic carbon, Nitrogen, Phosphorus, Crop yield, Heavy metals, Percolation, Fertilization.

Six slow rate land treatment prototypes, three containing a Windsor sandy loam and three containing Charlton silt loam, were studied from June 1974-May 1980. The systems were spray irrigated with either primary or secondary wastewater at application rates ranging from 2.5 cm/wk to 15 cm/wk. Application schedules were also varied. The performance of forage grasses was studied to determine the yield and nutrient uptake under the various application regimes. On a mass basis, an average of 91% of the nitrogen (N) applied could be attributed to either plant uptake or percolation of soluble N, mainly nitrate. Nitrate concentrations in the percolate correlated with N loading rate. An N loading rate of 800 kg/ha resulted in a mean concentration of about 10 mg/L of nitrate-N in the percolate. Plant uptake of N was linearly related to N loading rate at loading rates less than 800 kg/ha. In this range, plant uptake accounted for about 60% of the N applied. Plant yields averaged 13.1 tonnes/ha, three times the average for the area. Mean phosphorus (P) concentrations in the percolate ranged from 0.03 to 0.07 mg/L and depended only slightly on application rate. Removal of P averaged greater than 99% for all application regimes. Water balance measurements indicated that evapotranspiration exceeded pan evaporation by a factor ranging from 0.86 to 1.17 over a 6-year period. Treatment of biochemical oxygen demand (BOD5), suspended solids, total organic carbon (TOC), and fecal coliform were excellent. Residual levels of BOD5, suspended solids, and TOC in the percolate averaged 1.3, 1.2 and 1.8 mg/L, respectively. Fecal coliform bacteria in the percolate were reduced to detection limits independent of whether the wastewater was pretreated or disinfected before application. A significant reduction in chloroform and other volatile trace organics was also found. Mean concentrations of chloroform were reduced from 9.6 microgram/L in the chlorinated primary wastewater to about 0.2 microgram/L in the test cell percolates. No significant downward movement of heavy metals was found 5 years after suspension of heavy metal application. Potassium (K) fertilization was necessary to balance the low K/N ratio of the wastewater. (Brambley-SRC)
W82-02981

ULTRAVIOLET DISINFECTION OF A SECONDARY WASTEWATER TREATMENT PLANT EFFLUENT,
HydroQual, Inc., Mahwah, NJ.
O. K. Scheible, and C. D. Bassell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-242125, Price codes: A08 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-152, September, 1981. 8 p, 5 Fig, 2 Tab.

Descriptors: *Ultraviolet radiation, *Disinfection, *Coliforms, *Wastewater treatment, Microbiological studies, Secondary wastewater, Photoreactivation, Cost analysis.

Although ultraviolet (UV) light has been an accepted disinfection technique for potable waters, its application to lower-grade waters has not been widely practiced, primarily because of a lack of efficient system design. Recent improvements have made the UV process a viable alternative to chlorindation for the disinfection of wastewater treatment plant effluents. UV disinfection of a full-scale secondary effluent was investigated during a 13-month field study at Waldwick, New Jersey. Second order does response relationships were developed and were found to provide a rational expression of the microbial response to UV dose. The UV absorbance coefficient was found to be an excellent parameter for use in the dose expression and in the design sizing of UV systems. Photoreactivation was observed and was significantly dependent on temperature. The phenomenon could result in an order of magnitude increase in coliform density at a temperature of 20 degrees C. In operation, the process was flexible and simple, requiring minimal maintenance. Estimated costs ranged between 1.2 and 0.8 cents/cu m for typical secondary treatment plants with flows between 0.044 and 4.4 cu m/sec, respectively. (Moore-SRC)
W82-02985

CHARACTERIZATION OF BOLIDEN'S SULFIDE-LIME PRECIPITATION SYSTEM,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
M. Blythe, K. Schwitzgebel, J. C. Terry, C. Sund-Hagelberg, and D. Bhattacharyya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209272, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-081, August, 1981. 8 p, 5 Fig, 5 Tab, 6 Ref. R804568.

Descriptors: *Wastewater treatment, *Sulfides, *Heavy metals, *Arsenic, *Industrial wastewater, Chemical treatment, Chemical precipitation, Copper, Cadmium, Mercury, Lime.

Sulfide precipitation is an effective process for the treatment of industrial wastes containing highly toxic heavy metals. The attractive features of the sulfide precipitation process are: attainment of a high degree of metal removals over a broad pH range, effective precipitation of certain metals (such as As, Cu, Cd, Hg) even at very low pH, low detention time requirement in the reaction tank because of the high reactivity of sulfides, and the feasibility of selective metal recovery. Bench-scale studies were conducted with actual scrubber wastewaters obtained from a non-ferrous metal production plant. Full-scale data were obtained at Boliden Metall Corporation, Skelleftehamn, Sweden. A high degree of separation of heavy metals and arsenic was achieved using a combination of hydroxide-sulfide precipitation (at pH 8-9) process, and a process involving sulfide precipita-

tion (at pH 3-5) followed by lime precipitation. The combination hydroxide-sulfide process required only 60% of the theoretical sodium sulfide dosage to provide effective separations of heavy metals and arsenic. Simple sulfide precipitation at pH 3-4 also provide excellent removals for Cu, Cd, Hg, and Pb. For precipitation of arsenic and zinc sulfide at less than pH 5, the side reaction between sulfite (if present in wastewater) and sulfide must be considered. Hydrogen sulfide gas formation was never found to be a problem during precipitation because of the high reactivity of sulfides and heavy metals. (Moore-SRC)
W82-02988

CHLORINE DIOXIDE FOR WASTEWATER DISINFECTION: A FEASIBILITY EVALUATION,
Stanford Univ., CA. Dept. of Civil Engineering.
P. V. Roberts, E. M. Aieta, J. D. Berg, and B. M. Chow.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-213357, Price codes: A08 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-092, July, 1981. 4 p, 3 Fig, 2 Tab.

Descriptors: *Wastewater treatment, *Disinfection, *Chlorine dioxide, *Chlorination, Chlorinated hydrocarbons, Coliforms, Viruses, Effluent, Residual chlorine, Sludge.

Chlorine dioxide was compared with chlorine for disinfecting wastewater in laboratory experiments. Chlorine dioxide disinfection was also demonstrated at a full-scale wastewater treatment plant. The criteria compared included coliform kill, inactivation of poliovirus and other indicators, and formation of halogenated organic byproducts. In general, chlorine dioxide accomplished a given fractional kill of total coliforms with a smaller product (residual x time) than did chlorine. For a given contact time, the residual required to achieve a given fraction kill of coliforms was 2 to 70 times smaller for chlorine dioxide than for chlorine. Considering both required residual and disinfectant demand, the required doses of the disinfectants were estimated to satisfy three assumed coliform disinfection levels with two types of effluents: conventional activated sludge and filtered, nitrified activated sludge. The required mass doses of the disinfectants were approximately equal for treating conventional activated sludge effluent. The required dose of chlorine was approximately 2 to 10 times greater than that of chlorine dioxide for treating filtered, nitrified effluent, depending on the coliform standard. The results of studies conducted at a full-scale plant generally agreed within a factor of two with the predictions from laboratory studies. For typical cases, chlorine dioxide is approximately 2 to 5 times as expensive as chlorine for disinfection, but chlorine dioxide forms much lower quantities of halogenated by-products and is more effective in inactivating viruses than is chlorine. (Moore-SRC)
W82-02989

OVERLAND FLOW TREATMENT OF POULTRY PROCESSING WASTEWATER IN COLD CLIMATES,
Notre Dame Univ., IN.
L. H. Ketchum, Jr., J. L. Witherow, A. J. Cunningham, and R. L. Irvine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-213225, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-093, July, 1981. 6 p, 1 Fig, 6 Tab.

Descriptors: *Food-processing wastes, *Wastewater treatment, *Overland flow, *Land disposal, Weather, Temperature effects, Industrial wastewater, Biological treatment, Evapotranspiration, Snow cover.

Land treatment of wastewater using overland flow methods has been effectively used in warm climates. A full scale wastewater treatment facility, including overland flow, was evaluated in northern Indiana, a cold climate. The treatment system included mechanical pretreatment facilities, a storage lagoon, a lagoon for batch chemical treatment of the overland flow effluent and rapid infiltration for effluent disposal. The facility treated wastewater from a duck processing plant. The wastewater was as amenable to biological treatment as domestic sewage and had similar concentrations of nutrients. Overload flow systems typically are limited to low permeability soils, but this system was located on a sandy loam soil with very high permeability. Bentonite was used to provide a percolation barrier below the grass covered surface. Total effluent flow averaged about 40% of the total influent, except during the winter. The high winter effluent flows resulted from low evapotranspiration rates, because the fields were snow covered, and low infiltration rates, because the ground was frozen. During all warm-weather periods, and under widely varying wastewater application schemes, the overland flow plots alone met the 1983 EPA limitations, except when algae problems were encountered. Some degree of treatment is possible in the winter, but the loading rate must be reduced, and unsatisfactory effluent returned for further treatment. Application of lagoon wastewater to an overland flow plot should be avoided if possible. (Moore-SRC)
W82-02992

WOOD PRESERVING INDUSTRY MULTIMEDIA EMISSION INVENTORY,
Acurex Corp., Mountain View, CA.
B. DaRos, B. Fitch, C. Franklin, M. Friedman, and R. Merrill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205999, Price codes: A12 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-066, September, 1981. 7 p, 2 Tab.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Evaporation, *Organic compounds, Sludge disposal, Surface runoff, Air pollution, Evaporation pans, Recycling, Water pollution control, *Wood preserving industry.

There are approximately 475 wood preserving plants in the United States. Wastewaters are generated as a result of the preservatives used, plant operations, surface runoff, and excess process water discharge. Solid residues include waste sludges from wastewater treatment, insoluble inorganic materials from waterborne salts, and contaminated soils from spills or drippage. Air emissions occur during wastewater evaporation processes. Industry's technical response to requirements for control of process wastewater has included increased recycling and evaporation of water using thermal evaporators, spray and solar ponds, and cooling towers to decrease aqueous discharges. Organic compounds are emitted to the atmosphere during evaporation. The rate of release is based on the type of evaporation system used: solar ponds, thermal (pan) evaporators, spray ponds, or cooling towers; the temperature (thermal) driving force used; the molecular weight and volatility of the substances; and the concentration of each component in solution following wastewater pretreatment. Eleven plants are likely to shut down and 10 others face potential shutdown if zero discharge regulations are implemented. (Moore-SRC)
W82-02993

PROTEIN RECOVERY FROM BEEF PACKING EFFLUENT,
Colorado State Univ., Fort Collins.
J. C. Ward, W. Adams, and H. C. Isaksen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-224362, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-112, August, 1981. 4 p, 2 Tab.

Descriptors: *Wastewater treatment, *Meat processing industry, Physicochemical treatment, *Waste recovery, *Proteins, Industrial wastewater, Biochemical oxygen demand, Suspended solids, Grease, *Cost analysis, *Protein recovery.

The wastewater from a large beef packing plant, containing 3,000 mg/l BOD5 and 2,500 mg/l of suspended solids was treated in a physicochemical process that recovers protein. This process removed 58% of the total nitrogen, 80% of the oxygen demand and suspended solids, and 94% of the fat, oil and grease. The discharge of BOD5 was reduced to less than 3 pounds per head of beef slaughtered. For every pound of BOD5 entering the wastewater treatment plant, 0.77 pounds of product was recovered with a composition of 38% protein, 11% grease and oil, 27% inorganic solids, and 24% other solids (dry weight basis). About 2 pounds of protein were recovered per head. Total cost was $3 per 1,000 gallons (44% capital costs). A price of 42 cents per pound of protein would pay all costs. The figures given above were observed in a full scale plant and should not change significantly with different size wastewater treatment plants. This wastewater treatment process can be used as a pretreatment process for beef packing effluent prior to discharge to a sewage treatment plant. (Moore-SRC)
W82-02994

GROUP TREATMENT EVALUATION FOR METAL FINISHERS,
Centec Corp., Reston, VA.
E. Comfort, D. Harrison, and D. Sherman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-232506, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-143, September, 1981. 2 p, 2 Tab.

Descriptors: *Metal-finishing wastes, *Wastewater treatment, *Economic aspects, *Sewers, Regulations, Industrial wastes, Financing, Cost analysis.

Group treatment is one alternative for firms faced with the problem of compliance with pretreatment regulations. A preliminary study of the concept as applied to the plating firms within Huntington Industrial Park, Providence, Rhode Island, was conducted. Each potential participant was surved and wastewater sampled. Results were entered into a joint treatment model used to size the Group Treatment Facility. It was found that, with the assumed 10 participating firms, substantial savings could be realized. Installation of an industrial sewer system within the park, while more than doubling the demands for initial capital, would be cost-effective in the long run. The capital required was estimated at $300,000 to $500,000. The SPA Pollution Control Financing Guarantee Program was shown to be very attractive for such amounts, particularly when combined with an issue of tax-exempt bonds. Relatively small additional investment would allow process capacities to be increased so that the same facility could accept similar wastes from some of the very small job shops in the region, those which otherwise would be most severely impacted by pretreatment regulations. (Moore-SRC)
W82-02995

NITROGEN AND PHOSPHORUS REACTIONS IN OVERLAND FLOW OF WASTEWATER,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
R. A. Khalid, I. C. R. Holford, M. N. Mixon, and W. H. Patrick, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-239311, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-150, September, 1981. 6 p, 6 Fig, 1 Tab.

Descriptors: *Overland flow, *Wastewater treatment, *Phosphorus removal, *Nitrogen removal, Soil chemistry, Municipal wastewater, Land disposal, Model studies, Nitrification, Flooding, Vegetation effects.

Biochemical transformations of labelled ammonium-nitrogen resulting from the overland flow treatment of simulated wastewater were studied in small scale test models established with vegetated soils. Water movement in the system was primarily

controlled by the application rate the friction slope, the slope angle, the hydraulic characteristics of soils, and the evapotranspiration. Aerobic-anaerobic zones in the soil mass facilitate nitrification denitrification processes and enhance nitrogen losses to the atmosphere. The incomplete nitrification of ammonium nitrogen in the simulated wastewater applied to overland flow models suggests that nitrification reactions may be limiting the proportion of nitrate-nitrogen available for denitrification reactions. The loss of applied ammonium-nitrogen attributed to denitrification reactions ranged from 3 to 35%. The plant uptake of nitrogen in the overland flow and growth chamber studies accounted for 23 to 62% of applied ammonium-nitrogen. The results of laboratory studies indicated that initial flooding of aerated soil for about three weeks was accompanied by a large increase in phosphorus sorption capacity and decrease in phosphorus mobility. Longer periods of flooding caused a marked decrease in phosphorus sorption capacity and a corresponding increase in phosphorus mobility and leaching losses in acid soils. Calcium phosphate precipitation under alkaline soil conditions increased phosphorus sorption capacity of soils. The results of the overland flow experiment also demonstrated that the efficiency of phosphorus removal from municipal wastewater was greatly enhanced by lime addition to the soil compared to nonlimed flooded soil. (Moore-SRC)
W82-02996

FATE OF TOXIC AND NONCONVENTIONAL POLLUTANTS IN WASTEWATER TREATMENT SYSTEMS WITHIN THE PULP, PAPER, AND PAPERBOARD INDUSTRY,
Jordan (Edward C.) Co., Inc., Portland, ME.
B. K. Wallin, and A. J. Condren.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-247405, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-158, September, 1981. 4 p, 2 Tab.

Descriptors: *Pulp and paper industry, *Industrial wastewaters, *Wastewater treatment, *Sludge, Pollutants, Air pollution, Organic compounds, Wastewater analysis, Biological wastewater treatment.

A sampling and analysis program was conducted at two deink mills and a groundwood fine papers mill. Each mill employed a wastewater treatment system which included primary clarification, high rate biological treatment, secondary clarification, and combined primary/secondary sludge dewatering. An attempt was made to complete a mass balance of the pollutants under study through a sampling program including primary clarifier influent, biological treatment effluent, air emissions above the aeration tanks, and dewatered sludge solids. In general, 50% of the mass of each pollutant found in the mill's raw wastewaters were accounted for in the program. The accountability of the volatile organic pollutants ranged from 27 to 55%. The accountability of semivolatile pollutants ranged from 6 to 933% with three pollutants accounted for in excess of 100%. The objective of accountability was not achieved due to several factors, including: biochemical transformation; quantity of pollutants, detection limits, sample matrix, and analytical procedures; sampling procedures; and capability to accurately estimate air and sludge emissions. It is unrealistic to anticipate 100% accountability; however, through more controlled conditions, more advanced sampling techniques, and higher resolution analytical techniques, improved accountability should be a realistic goal. (Moore-SRC)
W82-02998

NICKEL RECOVERY FROM ELECTROPLATING RINSEWATERS BY ELECTRODIALYSIS,
Chemical Recovery Systems, Hanover, MA.
J. L. Eisenmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-227209, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-130, October, 1981. 4 p, 2 Fig, 1 Tab.

Descriptors: *Metal-finishing wastes, *Electrodialysis, *Wastewater treatment, *Industrial wastewater, Cost analysis, Water use, Nickel, Waste recovery, Recycling.

A program to demonstrate the feasibility of metal salt recovery and pollution control on a Watts-type nickel plating line by electrodialysis was conducted at Risdon Manufacturing Co., Waterbury, Connecticut. Each of two reclaim rinse tanks was treated by recirculating the rinse solutions through separate electrodialysis stacks. The first rinse solution was maintained at 2-5 g/l nickel and the second rinse held at 0.3-0.4 g/l nickel over several months of plating operations. The nickel salts recovered from the rinse solutions were concentrated 20-fold by the electrodialysis treatment and could be returned directly to the plate tanks for reuse. The process is capable of reducing nickel content in plating line effluents to the ppm range, can recover 95% of the nickel salts lost with conventional rinsing techniques and substantially reduce other raw material usage, and can minimize the effort and space required for operation of standard destruct equipment. For plating operations similar to the demonstration line yearly savings are estimated to be at least $16,000 in raw materials with a concomitant decrease of about 2,300 kg in sludge from pollution control facilities. Net cost savings should increase as chemicals become more expensive and pollution regulations more stringent. Depending on the operation of the plating line, additional savings may be realized on water usage, storing and handling of chemicals, improved rinsing, and additive recovery. (Moore-SRC)
W82-03000

5E. Ultimate Disposal Of Wastes

ONTARIO'S SEVEN-POINT PLAN FOR THE TREATMENT AND DISPOSAL OF INDUSTRIAL WASTE LIQUIDS AND SLUDGES,
J. Donnan.
Water and Pollution Control, Vol 118, No 7, p 28, 34, July, 1980.

Descriptors: *Wastewater treatment, *Effluents, Planning, Sludges, Ontario, Industrial wastes, Decision making, *Wastewater disposal.

As of November of 1979 three firms in Ontario were certified to deal with the disposal of organic wastes. Tricil operates an incinerator at Corunna which can burn about 15 million gallons annually. Frontenac Chemical Waste Services Ltd in Hamilton recovers oils and solvents as well as operating an experimental solidification facility. Woodington Systems Inc. operates an oil and water separation facility and landfills industrial sludges. No facilities exist in the province that are fully approved to accept all types of chemical wastes, although 23 landfill sites are able to accept specific kinds of organic and inorganic wastes. Thousands of liters of waste liquids and sludges each year find their way to landfills that are not specifically approved to handle them. Even so there are few reported instances of damages of any kind resulting from the improper disposal of these materials. A 'Seven-Point Program' has been devised for the treatment and disposal of industrial waste liquids and sludges. Included in these seven elements are: way-bill monitoring, classification of wastes, water disposal guidelines, regulations, perpetual care, transboundary movement of wastes, and facilities and site selection. However, the program has some drawbacks. The impact of the program cannot be reviewed, as the data has not been disclosed publically. No emphasis on incentives to waste generators to change their processes was included in the program. No explicit consideration was given to the costs to the participating firms of meeting the new changes. (Baker-FRC)
W82-02603

CURRENT POLICIES ON LAND APPLICATION,
N. Goldstein.
BioCycle, Vol 22, No 5, p 39-41, September/October, 1981.

Descriptors: *Land application, *Sludge disposal, *Political constraints, Philadelphia, New York, Political aspects, Ocean dumping, Composting, Water law, Water policy, Policy making, Legal aspects, Water pollution control.

Lack of firm policies for municipal sludge disposal results in confusion and waste in the waste treatment industry and municipal budgets. An example was seen in the City of New York, which developed a plan for sludge composting on sites within city limits. A complex court action involving the EPA and local officials, as well as public opposition, allowed continuation of ocean dumping of sludge past the December 31, 1981, deadline. As a result, Nassau County's new $15 million sludge dewatering plant, in the final stages of completion, will not be used in the foreseeable future. Hauing the sludge to the proposed dump site 106 miles offshore will cost $5-10 per wet ton, vs. $1.41 for the present 12 mile site. In contrast, Philadelphia dumped its last bargeload of sludge into the ocean on November 26, 1980. The city has begun a sludge utilization program, which involves land application near the city and in strip mined land 250 miles away. Trucks transport sludge to the dump sites and return filled with coal. In this case strict Region III EPA enforcement plus public support for land application gave Philadelphia the opportunity to develop a successful program. (Cassar-FRC)
W82-02629

THE STATUS OF NUCLEAR WASTE MANAGEMENT,
Argonne National Lab., IL.
J. H. Kittel.
Journal of Environmental Sciences, Vol 23, No 5, p 28-32, September/October, 1980. 9 Fig, 13 Ref.

Descriptors: *Radioactive wastes, *Nuclear engineering, *Toxicity, *Metals, *Fuel reprocessing, Nuclear reactors, Powerplants, Wastes, Waste storage, *Waste management, Waste characteristics, Liquid wastes, Plutonium, Plutonic water.

The status of nuclear waste management is discussed. High-level nuclear waste can be safely stored and isolated through a multiple barrier approach. Although it is a hazardous material, its toxicity diminishes rapidly. It then becomes less hazardous than other materials that are dealt with routinely. Detailed studies are needed regarding the geologic structures used as possible high-level waste repositories, especially studies of groundwater conditions. The geologic structure selected must either be free of groundwater or be one in which groundwater is moving very slowly and not into any aquifers from which drinking water might be obtained. Natural demonstrations of radioactive waste isolation exist at some groundwater-saturated ore deposits, and observations of these natural formations have been very encouraging with regard to the low migration of radioactive elements. Low-level waste has not attracted very much public attention. The technical strategy for disposal involves reducing the volume of the waste, packaging it in steel barrels, and storing the barrels in earth-covered trenches. 100 to 200 years of isolation are required. The management of uranium mill tailings is similar in many technical respects to the management of low-level wastes. (Titus-FRC)
W82-02659

BACTERICIDAL EFFECT OF SEAWATER CONTAINING DIGESTED NIGHT SOIL AND MARINE PLANKTON AGAINST INTESTINAL BACTERIA, (IN JAPANESE),
Yamanashi Univ., Kofu (Japan). Dept. of Environmental Engineering.
O. Nakayama, and M. Ohno.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 47, No 2, p 165-169, 1981. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Bacteria, *Ocean dumping, *Waste disposal, Plankton, Wastewater, Wastewater disposal, Enteric bacteria, Path of Pollutants, Bacterial analysis, Light intensity.

In order to estimate the sanitary problems of ocean fertilization with night soil, the effect of digested night soil, marine plankton and light on the viable count of intestinal bacteria in sea water was examined. One hundred ml each of aged seawater with or without digested night soil (1%), phytoplankton and zooplankton were inoculated with Escherichia coli, Salmonella typhimurium or Vibrio parahaemolyticus. The samples were then shaken with or without illumination for several days at 20 degrees C. The phytoplankton used included Nitzschia closterium, Phaeodactyllum tricornutum, Dunaliella tertiolecta, Brachiomonas sp., Chlamydomonas sp., Platymonas sp., Nannochloris sp., and Chlorella sp. The zooplankton was Tigriopus japonicus. Selective media were used each day to count the bacterial cells. E. coli and S. typhimurium survived more than 6 and 15 days, respectively, in dark, clean seawater, and V. haemolyticus propagated. In illuminated seawater containing digested night soil and marine plankton E. coli, S. typhimurium and V. haemolyticus died off within 1 to 3 days. (Baker-FRC).
W82-02799

THE DEVELOPMENT OF A VILLAGE WATER SUPPLY SYSTEM ON TRUK,
Guam Univ., Agana. Water and Energy Research Inst.
For primary bibliographic entry see Field 5F.
W82-02816

FLUE GAS DESULFURIZATION SLUDGE DISPOSAL PRACTICES FOR COAL-FIRED STEAM AND POWER PLANTS,
Gibbs and Hill, Inc., New York.
H. A. Schlesinger.
Mining Engineering, Vol 32, No 10, p 1516-1520, October, 1980. 3 Fig, 10 Ref.

Descriptors: *Industrial wastes, *Waste disposal, *Sludge disposal, *Sludge treatment, Chemical wastes, Solid wastes, Sulfur, Fly ash, Landfills, Mine drainage, Regulations, Water quality control, Ponding, Lime, Limestone, Oxidation, Land disposal, Solid waste disposal.

Some of the alternatives for the handling and dipsoal of throw-away lime, limestone and dual alkali process solid wastes are discussed in view of the increasing number of sulfur emitting power plants that use lime or limestone as sulfur reducers. The advantages, disadvantages and economics of such methods as wet ponding without thickener, wet ponding with separate thickener, dewatering plus landfill, wet blending plus pipelining to disposal area, dry blending plus landfill, wet fixation plus pipelining to disposal area and mine disposal are considered. Plant size, the forced oxidation of sludge, and operating problems with sludge disposal are examined, along with sludge disposal regulations under the Resource Conservation and Recovery Act. It was concluded from the study that costs for sludge disposal are site specific. Some low cost disposal options include ponding and blending plus mine disposal and forced oxidation. Since deep mine disposal of some sludges may cause environmental problems of gas generation and impaired water quality, future land use should be considered when selecting the disposal site. The order of magnitude area requirement for a 3.5% sulfur, 14% ash, 27.9 MJ/kg coal, 30 year life, and 70% average capacity factory is about 40.5 sq dam/MW power or equivalent steam. The stabilization of scrubber sludge by fixation or blending is recommended to improve the properties and decrease leachability. (Geiger-FRC)
W82-02907

EVALUATION OF HIGH- AND LOW- SPEED CENTRIFUGES,
Water Pollution Control Plants, Philadelphia, PA.
W. Wankoff, T. Lauletta, and R. Shah.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1568-1573, November, 1981. 5 Tab.

Descriptors: *Centrifugation, *Dewatering, *Sludge drying, Sludge, Sludge disposal, Mechanical equipment, Philadelphia.

The development of sludge dewatering facilities in Philadelphia gave the water department experience in the design and operation facilities utilizing centrifuges. Presently, a low-speed/low-G machine is being used to dewater anaerobically digested primary sludge. Higher speed/higher-G machines are used to dewater a mixed 60%-primary/40%-secondary anaerobically digested material. The centrifuges have operated satisfactorily although there have been problems with peripheral equipment. When sludge dewatering is required on a continuous basis, there must be sufficient duplication within the system to permit down-time of equipment such as sludge grinding equipment, feed pumps, etc. (Small-FRC)
W82-02931

5F. Water Treatment and Quality Alteration

ENERGY MANAGEMENT IN THE WATER WORKS INDUSTRY,
Metcalf and Eddy, Inc., Boston, MA.
D. Brailey, and A. Jacobs.
Journal of the New England Water Works Association, Vol 94, No 3, p 216-239, September, 1980. 9 Fig, 8 Tab, 10 Ref.

Descriptors: *Water treatment, *Water treatment facilities, *Electric power costs, *Cost analysis, Utilities, Chemical treatment, Coagulation, Alum, Fuel, Energy, Water distribution, Water management, Electric power rates, Electric power demand, Operating costs.

Methods to optimize energy use in the treatment and distribution of water are explored. In general, 1200-1800 KWH of energy, usually in the form of electricity, per million gallons of water are required to drive motor operated pumps and equipment, to effectively acquire, treat, and distribute water. Rate structures vary among utility companies and usually combine a mixture of connection demand, reactive demand, standy, basic energy, time-of day, and fuel adjustment charges. A hypothetical electric rate schedule and utility were used to calculate the savings available from various electrical energy management measures. The utility serves a population of 75,000 with 10 MGD. The total estimated electricity usage of the facility is 450,000 KWH per month. Several ways to reduce the demand charge on the electric bill are listed. To reduce basic energy costs, several measures are recommended, such as using high-efficiency motors, improvement of pump efficiency, increasing system storage, reducing unaccounted for water, checking distribution system valves, and cleaning and lining pipes. The time of day charge effect may be optimized by running scheduled equipment during non-peak hours. The conservation of chemicals used in water treatment is illustrated in methods of coagulation control and alum recovery. (Geiger-FRC)
W82-02608

AQUIFER DECONTAMINATION FOR VOLATILE ORGANICS: A CASE HISTORY,
New Jersey Bureau of Ground Water Management.
W. F. Althoff, R. W. Cleary, and P. H. Roux.
Ground Water, Vol 19, No 5, p 495-504, September/October, 1981. 4 Fig, 2 Tab, 3 Ref.

Descriptors: *Chlorinated hydrocarbons, *Water pollution treatment, *Industrial wastes, Solvents, Plumes, Aquifers, *Groundwater pollution, Organic compounds, Trichloroethane, Tetrachloroethylene, Path of pollutants, Water pollution sources, Chemical wastes, Water quality control.

In December 1977 organic solvents, including 1,1,1-trichloroethane and tetrachloroethylene, were found in a municipal well in South Brunswick Township, New Jersey, at concentrations of 150-1500 ppb and 100-300 ppb, respectively. A hydrologic study determined that the source was an industrial plant. Under the plant site the Old Bridge aquifer was contaminated with as high as 40,000 ppb trichloroethane. Concentrations greater than 100 ppb extended 1000 ft downgradient of the plant. To protect a municipal well located 2500 ft from the plant, the industrial site was inspected and tanks, drains, sumps, etc., cleaned and repaired. A pollution abatement system with design rate of 198,000 gpd was installed. This consists of seven extraction wells, a treatment facility, two cooling towers in series to air strip volatile organics from the water, and two half acre, 10 ft deep infiltration ponds to return the water to the aquifer. During the 10 months of operation, there have been contaminant reductions of 87% and 93% in two of the decontamination wells, noticeable reductions in two other wells, and no improvement in three wells. The contamination plume has been substantially reduced in extent and concentration. The aquifer is expected to be decontaminated within several years, after which the treatment process will be discontinued. (Cassar-FRC)
W82-02613

CHEMICAL COAGULATION OF SURFACE WATER,
Johnson (C.C.) and Associates, Inc., Silver Spring, MD.
J. A. Susan, and R. M. Gruninger.
Industrial Water Engineering, Vol 18, No 4, p 14-18, July/August, 1981. 4 Tab, 2 Ref.

Descriptors: *Coagulation, *Chemical coagulation, *Surface water, Alum, *Water treatment, Polymers, Lakes, Ferric chloride, Magnesium carbonate.

This paper reviews some of the factors relating to chemical treatment of surface waters as experienced in field and laboratory studies at several water treatment plants processing Lake Erie and Lake Ontario water. In one plant an automatic coagulation control center closely regulates chemical dosages. In another facility plant scale tests with ferric chloride in place of alum produced finished water of similar quality, but caused higher Fe concentrations, more turbid water before filtration, rusty filter backwash water, difficulty in handling, and 20% higher cost. Alternative coagulants or coagulant aids suggested are magnesium carbonate (uneconomical for plants smaller than 20 mgd) and organic polymers. Sludge considerations include alum recovery (by sulfuric acid addition or solvent extraction), dewatering properties, and disposal. (Cassar-FRC)
W82-02623

METHOD AND APPARATUS FOR SUPPLYING DISSOLVED CHEMICALS INTO WATER,
Metallgesellschaft, A.G., Frankfurt am Main (Germany, F.R.). (Assignee).
K. Lohrberg, R. Pfohl, J. Schubert, M. Gritschke, and J. Freytag.
U.S. Patent No 4,230,569, 4 p, 1 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1538-1539, October 28, 1980.

Descriptors: *Patents, *Water treatment, *Industrial water, *Stream flow, Application equipment, Chemicals, *Dissolved solids, Horizontal flow.

An apparatus is provided for supplying dissolved chemicals into horizontally flowing streams of sea water or river water which are to be chlorinated for use as cooling water, e.g., for power plants. The apparatus comprises a horizontal conduit through which the water passes. A stationary manifold placed above the level of flowing liquid has vertical discharge hoses of differing lengths, each of which has an outlet opening below the level of the flowing water. The outlet openings are evenly distributed throughout the cross-section of the flowing water. The chemicals can be readily introduced into the aqueous streams with a particularly high degree of even distribution owing to the disposition of the discharge hoses which promote the distribution of the chemicals by oscillation. (Sinha-OEIS)
W82-02625

THE CLEAR LAKE EXAMPLE: AN ECOLOGICAL APPROACH TO PEST MANAGEMENT,
S. F. Cooke.
Environment, Vol 23, No 10, p 25-30, December, 1981. 1 Tab, 11 Ref.

Descriptors: *Midges, *Aquatic weed control, *Algal control, *Ecological effects, *Insecticides, Insect control, Lakes, Weed control, Biological magnification, Fish, Fish establishment, Fish populations, Pesticides, Larvicides, DDD, DDE, DDT, Parathion, Copper sulfate, Aquatic insects, Toxicity.

In efforts to control the populations of Chaoborus astictopus (termed gnats, although actually midges) and blue-green algae in Clear Lake, Lake County, California, ecological investigations were initiated in 1961. Prior to these studies, chemical control programs for C. astictopus using DDD, methyl parathion, and copper sulfate were tried but caused problems when the midges developed resistance to the chemical agents, and non-target species were affected by biomagnification of the pesticides through the food chain. In August of 1967, a few thousand Mississippi silverside fish (Menidia audens) were released into Clear Lake, and by 1969, they became the dominant fish in the lake. Also in 1969, a dramatic reduction in blue-green algae was noted over previous years. Gnat populations seemed to also be affected by the new fish in the lake, showing no signs of recovery to former densities even when chemical pesticide treatment of the lake was discontinued. No detrimental effects on sport fishing in Clear Lake have been observed since the introduction of M. audens, and the ecological approach to pest management in this case was regarded as successful. (Geiger-FRC)
W82-02660

NEW CONCEPTS IN FILTRATION PLANT DESIGN AND REHABILITATION,
Southern California Metropolitan Water District, Los Angeles.
A. E. Bowers, and J. D. Beard, II.
Journal of the American Water Works Association, Vol 73, No 9, p 457-463, September, 1981. 9 Fig, 12 Ref.

Descriptors: *Filtration, Water treatment, Coagulation, Control systems, Sedimentation, Backwash, *Water treatment facilities, Design criteria, *Southern California.

Changes in the Metropolitan Water District of Southern California's five water filtration plants (total 63,240 ML per day) have been both subtle and radical. All are presently of conventional design (coagulation, flocculation, sedimentation, dual-media filtration, and disinfection). Some of the modifications used in the District's plants are introduction of coagulants into the turbulent wake produced by an energy dissipation device, traveling bridges for sedimentation basin sludge removal, a single wash trough to collect used filter wash water, three-way valves in filter equipment, optimum design configuration for surface wash water jets, large storage tanks for preliminary settling and to buffer major fluctuations in raw water quality, and computer-based process control. (Cassar-FRC)
W82-02681

OZONE WATER TREATMENT,
S. Smith.
Water Well Journal, Vol 35, No 10, p 70-71, October, 1981. 1 Fig, 1 Tab.

Descriptors: *Ozonation, *Disinfection, *Water treatment, Ozone, Economic aspects, Construction costs, Operating costs, Chlorination, Costs, Well water.

Ozonation, used in over 1000 European and Asian cities as a primary water treatment, is not as common in North America: 20 plants in Canada and a handful in the U.S. Some advantages of ozonation are: (1) destruction of organic precursors of trihalomethanes, (2) destruction of hydrogen sulfide, (3) precipitation of dissolved Fe and some other metals, and (4) no chlorine taste. Ozonators are more expensive to construct and operate than chlorination systems, but are long-lasting, simpler to operate, and do not require chemicals. (Cassar-FRC)
W82-02682

METHODS FOR EVALUATING PERFORMANCE OF FILTER MEDIA,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W82-02684

RESTORING AN ANTIQUE WATER SYSTEM.
Water/Engineering and Management, Vol 128, No 10, p 31-32, 1981.

Descriptors: *Water distribution, *Water conveyance, Water supply, Pipes, Rehabilitation, Conveyance structures, Linings, *Burlington, *New Jersey, Water treatment, Water quality control, Iron, Manganese.

Iron and manganese content of water in the city of Burlington, New Jersey increased to levels which made the water unacceptable. The system serving the city was very old and repairs were difficult and costly. While sequestering was able to bring some relief to the situation, a study was conducted which yielded several conclusions. Treatment for iron and manganese removal was going to be necessary. The old water treatment plant could not treat the water without major modification and in all probability it would be less costly to construct a new plant. The old distribution system piping was probably contributing to the problem, but correcting it would have to be deferred until proper water treatment was provided. A major feasibility study was undertaken. The program devised called for construction of the new treatment plant, addition of elevated storage, and restoration of the very old water distribution system. Estimated cost of the entire project was between 10 and 15 million dollars. Cleaning and cement mortar lining of existing pipe was done to restore the pipe to like new condition with an estimated additional life in excess of 50 years. Two separate pipe rehabilitation contracts were involved. Elapsed time for the work was four years. The job was accomplished with a minimum of excavation, repaving and service interruption. (Baker-FRC)
W82-02685

COST ESTIMATES FOR WATER TREATMENT PLANT OPERATION AND MAINTENANCE.
For primary bibliographic entry see Field 6C.
W82-02697

WATER REGULATION IN AN INFLATIONARY ENVIRONMENT,
R. E. Hammond.
Journal of the New England Water Works Association, Vol 95, No 3, p 187-192, 1981.

Descriptors: *Planning, *Financial aspects, Water treatment, Water treatment facilities, Wastewater treatment, Drinking water, Financing, Costs, Case studies.

Various case histories are briefly cited which exemplify lack of proper financial consideration used in water supply problem solving steps. Cases involving meter reading, pH adjustment for water treatment processes, installation of a flash mixer, improper use of carbon filters, replacement tanks, and improperly conceived plant design are each considered. The general outcome of improper and incomplete planning is lack of public support and trust. The author stresses the need for a more complete understanding of the problems in any given area and a thorough investigation of proper solutions to the problems, including a thorough study of any monies needed to execute the plans and keep the system operable. (Baker-FRC)
W82-02701

A DYNAMIC PROGRAM FOR COAGULATION AND FILTRATION AT CHICAGO'S JARDINE WATER TREATMENT PLANT,
Illinois Inst. of Tech., Chicago.
A. E. Burgarino.
PhD Dissertation, 1980. 369 p, 52 Fig, 20 Tab, 114 Ref, 5 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-06292.

Descriptors: *Water treatment, *Water purification, *Coagulation, Statistical methods, Filtration, Automation, Turbidity, *Chicago, Jardine Water Purification Plant.

A computerized optimization program is developed for the Jardine Water Purification Plant at Chicago, Illinois. The purpose of the program is to calculate the required alum and polymer doses that not only yield an acceptable effluent turbidity, but also effect the lowest operating cost. The solution is complicated by the interaction of coagulation and filtration. There are two main perspectives. One is the systems approach of integrating the coagulation and filtration process by the solution framework of dynamic programming. The second is the development of a set of equations which predict (or simulate) turbidity removal and the rate of increase of filter headloss as functions of coagulant doses. These equations are used in the dynamic program to avoid a coagulant dose that results in an unacceptable filtered effluent turbidity or excessive headloss. It is shown how an optimization procedure based on statistical analysis of historic data can be used as part of a control algorithm for automated plant control. (Sinha-OEIS)
W82-02731

THE ROMAN WAY,
S. Lucas.
Water, No 40, p 13-15, September, 1981.

Descriptors: *Water quality management, *Sewer systems, *Water pollution prevention, Water quality control, Wastewater treatment, Water pollution control, *Water treatment, Water supply, Water resources development, Water supply development, Water management, *Rome, Future planning.

The city of Rome supplies 10% of its users with private connections to mostly nonpotable water sources. Azienda Comunale Electtricita' ed Acque (ACEA) is in charge of sterilizing water for users in Rome. Only small treatment plants are needed to remove hardness from water supplies from the Appenine Mountains. The Peschiera aqueduct supplies most of the water from the mountains. Long range plans include the building of a dam, a new aqueduct, and a sewerage system around Lake Bracciano to protect it as a water supply source. Metering systems help to curb water use, but plans are being implemented to phase out metering over the next 10 years. The consumers will soon be charged a nominal fee for sewage disposal. No general laws exist at present for sewage disposal. ACEA has been asked to organize district sewerage systems for outlying areas. The main purpose of these systems will be to protect water supplies. A plan is proposed to divide the Lazio region into three smaller sections to manage water pollution problems. The time needed for integration of water supply, sewage disposal and pollution control management will probably be extensive due to unstable conditions in the Italian government. (Geiger-FRC)
W82-02744

WATER SUPPLY AND SANITATION DECADE PROGRAMME,
National Environmental Engineering Research Inst., Nagpur (India).
B. B. Sundaresan, and S. T. Khare.
Aqua, No 5, p 16-18, 1981. 4 Fig, 2 Tab.

Descriptors: *Water supply development, *Sanitation, *India, Human diseases, Water scarcity, Water shortage, Administrative decisions, Decision making, International agreements, Financial aspects, Drinking water, Potable water.

Efforts underway in India to achieve the goal of the United Nations Water Conference of providing safe drinking water and effective sanitation for all people of the world during the decade 1981-1990 are cited. Awareness of the need to provide an adequate and wholesome water supply was recognized with the establishment of the Bhore Committee as early as 1944. A report from the Union Ministry of Health in 1964-65 indicated that about 66% of the Indian rural population lived in areas where it was easy to provide safe drinking water from local sources such as wells. The remaining

35% lived in villages where water scarcity was a way of life and in which engineering skills, extra financial outlays and time consuming work would be required to deliver proper water amounts. Comprehensive planning and large scale financial allocations were deemed necessary for implementation of water supply and sanitation programs at the state level. Administrative decisions and public support were lacking. The vast numbers of villages and people affected by various waterborne and water related diseases indicated the seriousness of the environmental health problem. Rapid assessment of the status of drinking water supply and sanitation in India was undertaken during 1977-80. In 1980 the government of India pledged support to the UN program. Almost all the equipment and materials required for water supply systems are currently available in India. Administration action has been initiated at various levels. Sufficient professionals are available to enable the work to proceed. (Baker-FRC)
W82-02757

PRACTICAL EXPERIENCES IN PLANTS USING ACTIVATED CARBON,
Gentofte Water Surply (Denmark).
P. K. Jensen.
Aqua, No 5, p 0321-0329, 1981. 13 Fig.

Descriptors: *Water treatment, *Activated carbon, Surface waters, Chlorination, Ozonation, Manganese, Organic matter, Algal growth, Eutrophication, Denmark, Filtration, *Lake Sjaelsoe, *Denmark.

Experience at a waterworks in Denmark is reviewed which led to the decision to use ozone plus activated carbon filtration as the last step in treatment of water from lake Sjaelsoe for drinking purposes. This plant is operational during March through November, with shutdown during winter when consumption is low, and to allow a complete overhaul. A seasonal bloom of algae occurs, which gives rise to taste and odor problems. Experiments to treat lakewater began in 1956 and included chemical treatment with sedimentation and filtration through rapid sand filters and ordinary slow sand filters. It was later discovered that blowing through with ozine before the filtration step gave additional improvement of taste and odor and gave the water a clear appearance as well. This treatment gave a solution to the problem of manganese removal from the lake water. While activated carbon filters are needed to provide acceptable taste and odor control, even if the water at the inlet to the activated carbon filters has a free chlorine content of about 1 mg/liter, there is a risk of bacterial growth across the filters. Post-chlorination has been instituted to obtain successful elimination of the organisms produced. In this case, where water production is based upon lake water for 15-25% of the total production, the economy of the situation is acceptable in relation to the influence on the cost price and the price which consumers must pay. (Baker-FRC)
W82-02788

BACTERIA FROM A SUSPENDED GROWTH SYSTEM AS ORGANIC PRECURSORS TO THE FORMATION OF TRIHALOMETHANES,
Missouri Univ-Rolla. Dept. of Civil Engineering.
F. Dolan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168519, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, 1981. 71 p, 12 Fig, 8 Tab, 31 Ref. OWRT- A-116-MO(2), 14-34-0001-0127.

Descriptors: *Bacteria, Ferric iron, *Chlorine, Chloroform production, *Water treatment, *Trihalomethanes, *Organic precursors, *Bacterial physiology.

The objective of this research was to study the bacteria from a suspended growth system as organic precursors to the formation of THMs. THM production was monitored as a function of initial chlorine dose and the concentration of bacterial mass as measured by turbidity. All tests were conducted on a batch basis. Ferric iron was also examined for its potential to act as a catalyst for THM production during the chlorination of bacterial cells. In a system saturated with chlorine, chloroform formation was found to increase linearly with the amount of cell mass used as an organic precursor. Chloroform production was also found to increase in relation to a greater exposure of cell surface area (e.g. dispersed cells vs. flocculated cells). Ferric iron appeared to catalyze chlorination reactions in water, causing increased chlorine consumption, but did not increase THM production.
W82-02806

NEW ANTIMICROBIAL AGENTS FOR TREATMENT OF WATER,
Auburn Univ., AL. Dept. of Chemistry.
S. D. Worley, H. H. Kohl, and W. B. Wheatley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168535, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, November 30, 1981. 10 p. OWRT-A-072-ALA(1), 14-34-0001-1101.

Descriptors: *Bactericides, *Disinfectants, *Water treatment, Water supply.

Several N-chloramine agents have been tested for their efficacy as bactericides in water. The compound 3-chloro-4,4-dimethyl-2-oxazolidinone (agent I) has proved to be the best of those tested, and in fact, definitely holds promise as an all-purpose water disinfectant for swimming pools, cooling towers, wells, military field units, the poultry industry, hospitals, and possibly even municipal water-treatment plants. It has been shown to be effective against a broad vicinity of bacteria and in a laboratory water treatment plant. It is a solid with appreciable solubility in water which retains its chlorine content in a demand-free situation almost indefinitely. It is stable in dry storage and in water solution, and it releases chlorine as necessary to kill bacteria upon demand. Preliminary tests indicate that it will not be toxic toward animal life. Furthermore, it should not cause the formation of toxic haloforms in water containing organic material.
W82-02808

THE DEVELOPMENT OF A VILLAGE WATER SUPPLY SYSTEM ON TRUK,
Guam Univ., Agana. Water and Energy Research Inst.
S. J. Winter, and R. A. Stephenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168618, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 28, 1981. 45 p, 27 Fig, 1 Tab, 4 Ref, Append. OWRT-B-003-GUAM(1), 14-34-0001-0261.

Descriptors: Water conveyance, *Developing countries, *Water supply development, *Water treatment, Wastewater treatment, Wastewater disposal, Public health, Potable water, Micronesia, *Truk, Caroline Islands.

The islands of Micronesia encompass only a little more than 1,000 square miles of land area in an arc lying across the face of the northwest and central Pacific. At present, the centralized water supply and wastewater treatment and disposal systems are located primarily in the various district centers. Most households in Micronesia obtain their fresh water from streams, springs, and household rainwater catchment systems. Toilet wastes are generally disposed of by means of privys over shallow shore waters, streams, or pits dug in the ground. Diseases associated with poor sanitary conditions are common. The objectives of this project are to improve the water utilization scheme of a typical Micronesian village in a manner that provides minimal disruption of normal cultural practices and to train Micronesians in these improvement procedures.
W82-02816

THE COST OF QUALITY,
Yorkshire Water Authority (England).
P. G. Clark.
Water, No 40, p 2-5, September, 1981. 4 Fig.

Descriptors: *Water supply, *Sewers, *Rivers, *Pipes, *Water quality, Potable water, Disinfection, Leakage, Networks, water loss, Distribution, Dams, *Water treatment, Filtration, Flow, Channels, Costs.

The Yorkshire Water Authority has reduced its annual capital expenditures since 1974. The reductions were a result of reorganization, customer demands, and the regional economic climate. Due to the cutbacks in spending, the Water Authority has adopted a maintenance policy which responds only to the most severe problems on an ad hoc basis. Projections of future maintenance problems and costs have been prepared. These include repairs to dams and service reservoirs, upgrading water quality, and replacing unlined cast iron pipes. (Titus-FRC)
W82-02881

EVALUATING A PLANT'S POTENTIAL FOR UPGRADING,
Freese and Nichols, Inc., Austin, TX.
A. J. Huckabee, and J. T. Garrett, Jr.
Journal of the American Water Works Association, Vol 73, No 9, p 478-483, September, 1981.

Descriptors: *Water treatment facilities, *Design criteria, Systems engineering, Alternative planning, Planning, Hydraulic equipment, Construction.

A three-phase method is suggested to evaluate the feasibility of upgrading an existing water treatment plant. In Phase 1, documentation, all available physical data on the plant are collected and facilities inspected to gather any missing information. Phase 2, analysis, is concerned with treatment effectiveness, capacities, and serviceability of the following: raw water intake, low-lift pumps, flow splitting and distribution, rapid mix equipment, flow distribution, flocculation basins, settling basins, settled water collection, transport to filters, filter boxes and media, piping systems, and backwash system. Phase 3, synthesis, proposes several plant layout alternatives. The most cost effective proposal is selected, presented to the client. and described in a final report. (Cassar-FRC)
W82-02895

ADSORPTION OF DISSOLVED ORGANICS IN LAKE WATER BY ALUMINUM OXIDE. EFFECT OF MOLECULAR WEIGHT,
Eidgenoessesche Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
J. A. Davis, and R. Gloor.
Environmental Science and Technology, Vol 15, No 10, p 1223-1229, October, 1981. 8 Fig, 57 Ref.

Descriptors: *Adsorption, *Water treatment, *Organic compounds, *Lakes, *Aluminum oxide, Disinfectants, Chlorine, Organic carbon, Suspended solids, Hydrogen ion concentration, Separation techniques, Electrophoresis, Drinking water, Chromatography, Dissolved solids, Geochemistry.

The role of adsorption in the geochemical cycle of organic carbon in lacustrine environments and the binding of polar organic compounds at the oxide surface were studied in laboratory experiments with water samples from Lake Greifensee, Switzerland. Dissolved organic compounds were fractionated by gel exclusion chromatography into three molecular size classes. The adsorption of each fraction onto colloidal alumina was studied as a function of pH. Low molecular weight compounds were weakly absorbed, while organic compounds with molecular weights over 1000 formed strong complexes with the alumina surface. Measurements of electrophoretic mobility showed that alumina particles suspended in the original lake water had high negative charges due to adsorbed organic matter with molecular weights usually in the range of 1000 to 3000. During alum coagulation in the treatment of drinking water, the preferential removal of trihalomethane precursors may be caused by the adsorption of the high molecular weight organic compounds. Adsorption may also

affect the molecular-weight distribution of dissolved organic material in lakes. (Geiger-FRC)
W82-02940

THE EQUILIBRIUM FLUORIDE CAPACITY OF ACTIVATED ALUMINA,
Houston Univ. at Texas.
G. Singh, and D. A. Clifford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124075, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-082, July, 1981. 5 p, 5 Fig, 2 Tab.

Descriptors: *Water treatment, *Fluoride, *Activated alumina, *Adsorption, Ionic interference, Equilibrium, Hydrogen ion concentration, Municipal water.

Current estimates are that there are several thousand public water supplies in the U.S. with excessive fluorides, especially in the 1.4 to 5.0 mg/l range. Many of these communities may eventually install activated alumina treatment systems to remove the excess fluoride. Because design limitations for a defluoridation process were unavailable, laboratory studies were performed to establish the maximum (equilibrium) fluoride capacities for activated alumina as a function of pH and competing ions. Fluoride adsorption tests were run using mini-columns containing 1g of acid-treated Alcoa F-1 activated alumina equilibrated for 6 to 10 days with a continuous flow of fluoride solution at a constant pH. Maximum fluoride adsorption capacities in distilled water solutions of sodium fluoride were found to be 8000 g F/cu m at 3.0 mg F/L and 9100 F/cu m at 6.0 mg F/L. The optimum pH range for fluoride adsorption was 5 to 6. Less than 50% of these capacities are estimated to be attainable in actual municipal defluoridation practice because of poor kinetics and competing ion effects. Fluoride capacities were not significantly reduced by competition from chloride or bicarbonate; however, at a typical sulfate concentration (250 mg/L) the fluoride adsorption capacity was reduced 28% at pH 6. It was observed that as pH increased from 6 to 8, the rate of fluoride adsorption also increased. (Moore-SRC)
W82-02968

INORGANIC CONTAMINANT REMOVAL FROM DRINKING WATER BY REVERSE OSMOSIS,
Charlotte Harbor Water Association, Inc., Harbour Heights, FL.
M. R. Huxstep.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-224420, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-115, October, 1981. 2 p, 1 Tab.

Descriptors: *Water treatment, *Reverse osmosis, *Fluoride, *Nitrate, *Arsenic, Hardness, Groundwater, Dissolved solids, Calcium, Magnesium, Chloride, Sodium, Sulfate, Inorganic contaminants.

The removal of inorganic contaminants from drinking water was studied using two reverse osmosis (RO) treatment systems. A high pressure (400 psi) and low pressure system (200 psi), each having a rated capacity of 1.82 L/sec (28.9 gpm) of product water, were used to evaluate their capability for removing various inorganic contaminants. A groundwater was spiked with varying concentrations of fluoride, nitrate, arsenic III, and arsenic V, and runs of 2 to 5 days were conducted to determine rejections. Removal data were also collected on the natural constituents in the feed water of total dissolved solids, hardness, calcium, magnesium, chloride, sodium, and sulfate. For all contaminants and natural constituents measured, the high pressure system operated at 265 to 359 psig more effectively removed the inorganic contaminants than did the low pressure system operated at 163 to 187 psig. High pressure system removals ranged from 80 to 99%; low pressure, from 10 to 85%. Percent removals varied with the ion measured, but the order, from best to worst, was about the same for each system. The order for the high pressure system was: (1) arsenic V, (2) fluoride, (3) arsenic III, and (4) nitrate. Percent removal was also independent of the initial concentration.
W82-02969

REMOVING TRACE ORGANICS FROM DRINKING WATER USING ACTIVATED CARBON AND POLYMERIC ADSORBENTS,
Iowa State Univ., Ames.
C. S. Oulman, V. L. Snoeyink, J. T. O'Connor, and M. J. Taras.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-119768, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-077,078,079, 53 p, July, 1981. 5 p, 1 Tab.

Descriptors: *Adsorbents, *Activated carbon, *Drinking water, *Trihalomethanes, *Chloroform, Fulvic acids, Humic acids, Resins, Organic carbon, Water treatment, Chlorinated hydrocarbons, Halogenated hydrocarbons.

Adsorption isotherms and bench-scale column studies were used to compare the performance of five types of commercially available activated carbons and four types of resins for removing humic acids, fulvic acids, 2-methylisoborneol (MIB), and chloroform from water. For adsorbing humic materials, some of the activated carbons and the weak base phenol-formaldehyde resins performed satisfactorily. The same activated carbons provided satisfactory removal of MIB, although the capacity was reduced somewhat in the presence of humic acid. The carbonaceous resin and one of the activated carbons had about the same capacity for chloroform removal at concentrations under 0.5 mg/l. The presence of 10 mg/l of humic acid had little effect on their capacity for adsorbing chloroform. In studies using pilot plant adsorption columns to adsorb halogenated organic substances from softened, filtered Kansas City water, activated carbon and carbonaceous resin were able to remove trihalomethanes (TTHM) for extended periods. Conversely, strong and weak-base anion exchange resins were not able to remove the TTHM. Only the granular activated carbons were effective in removing significant amounts of the total organic carbon (TOC) present. Periodic steaming of the activated carbon columns reduced bacterial growth and enhanced TTHM and TOC removal. Regular backwashing of the activated carbon columns was also effective in reducing the accumulation of bacterial growth. (Moore-SRC)
W82-02987

SOURCES OF HALOGENATED HYDROCARBONS IN AN URBAN WATER SUPPLY,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W82-02991

5G. Water Quality Control

MANAGEMENT OF GROUND WATER CONTAMINATED BY AROMATIC HYDROCARBONS IN THE AQUIFER SUPPLYING AMES, IOWA,
Southern Illinois Univ. at Carbondale. Coal Extraction and Utilization Research Center.
For primary bibliographic entry see Field 5B.
W82-02611

THE STATUS OF NUCLEAR WASTE MANAGEMENT,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5E.
W82-02659

CROPLAND, BUFFER, AND STREAM: A CASE STUDY IN AGRICULTURAL NONPOINT SOURCE WATER POLLUTION,
Michigan State University, Department of Agricultural Engineering.
G. H. Aull, III.
PhD Dissertation, 1980. 235 p, 100 Fig, 19 Tab, 48 Ref. University Microfilms International, Ann Arbor, MI; Order No GAX81-01076.

Descriptors: *Water pollution control, *Water quality control, *Agricultural runoff, Agricultural engineering, *Nonpoint pollution sources, Vegetation, Buffer areas, Filter areas, *Michigan.

Agricultural cropland runoff, a type of nonpoint source water pollution, can degrade the quality of surface waters. Several related programs are directed at reducing nonpoint source water quality problems. One of the newer practices is the streamside grassed buffer or filter strip. A field-scale research project utilizing a vegetated filter area was planned. The three-year study began in January 1978. This dissertation presents conclusions concerning the vegetated buffer area based on one year of data collection and six major runoff occurrences. Statistically significant differences in water quality constituent concentrations and loads were measured in the runoff from the control and buffered fields. The data indicate that the vegetated buffer area reduced common agricultural water polluted (nutrients, sediment, and oxygen demand) in the cropland runoff by about 25%. The runoff flows were found to have a fairly substantial impact on stream pollutant loads and a lesser, though quite variable, impact on stream pollutant concentrations. The water quality of the stream was marginal, though very few water quality standards violations were noted. The viability of the practice is best determined by personal values associated with such a pollutant reduction, when compared to the cost. The potential exists for reducing these costs through farmer design and/or installation of vegetated buffer areas, though the impact of such on pollutant reduction is unknown. (Sinha-OEIS)
W82-02728

THE ROMAN WAY,
For primary bibliographic entry see Field 5F.
W82-02744

LAKE VATTERN,
For primary bibliographic entry see Field 2H.
W82-02755

SOUTH AUSTRALIA'S APPROACH TO SALINITY MANAGEMENT IN THE RIVER MURRAY,
South Australia Engineering and Water Supply Dept., Adelaide.
K. J. Shepherd.
Agricultural Water Management, Vol 4, No 1/3, p 335-352, 1981. 5 Fig, 8 Ref.

Descriptors: *Salinity, *Water quality management, Rivers, *River Murray, *Australia, Cropland, Irrigation practices, Groundwater, Groundwater pollution, Water pollution sources, Farming, Water quality, *Saline water intrusion.

The three River Murray States and the Commonwealth of South Australia have developed a coordinated program for controlling drainage and salinity problems in South Australia. This area of Australia receives less than 8 inches of rainfall a year, which means that no local river can be relied upon for substantial water supplies. The River Murray is the area's most reliable and important water resource. The most immediate threat to water quality in the river is salinity. Much of the groundwater in the area has a high salinity level, which passes to the river, which in turn increases in salinity levels as it passes downstream. Salinity enters the Murray River from the natural inflow of groundwater, from river structures such as locks and weirs, and from irrigation practices. High salinity levels increase the hardness of water supplied to domestic users, limit the types of crops which can be grown by the farmers, and cause corrosion, scale and poor steam quality for industrial water users. The South Australia salinity control program calls for the establishment of the Noora Drainage Disposal Scheme, which involves the pumping of irrigation drainage water from existing evaporation basins at Berri and Renmark to an out

of the valley basin some 20 km east of Loxton. Upgrading control works on existing evaporation basins, the Rufus River Interception Scheme, replacement of furrow irrigation with improved irrigation methods, technical support for conversion of overhead to undertree irrigation and the installation of adequate drainage, and advances on monthly entitlements which are used for dilution are all part of the program to decrease the salinity problem. (Baker-FRC)
W82-02761

THE EVOLUTION OF A REGIONAL APPROACH TO SALINITY MANAGEMENT IN WESTERN AUSTRALIA,
Perth Public Works Dept. (Australia).
For primary bibliographic entry see Field 4D.
W82-02763

FRENCH EXPERIENCE IN WATER POLLUTION CONTROL,
Compagnie Generale des Eaux, Paris (France).
P-L. Girardot.
Aqua, No 2, p 7-10, 1981. 12 Fig.

Descriptors: *Water pollution control, *Planning, *France, Water quality, *Watercourses, Administrative decisions, Management, Governmental interrelations.

A strong policy has been enforced in France over the past 15 years in efforts to restore watercourses. One of the major areas of effort has been in developing measures against pollution. The River Basin Financial Agency has been established, and the water policy within the Ministry of the Environment has been reorganized. The results obtained by the largest river basin financial agency, the Seine-Normandie basin, are good examples of the work of these agencies. Programs for dams, reservoirs, implementation of quality objectives, financial incentives compelling polluters to pay considerable taxes, and improvement of treatment facilities have all been areas of endeavor by these agencies. An essential complement of these administrative actions is the development of techniques enabling reduction of the pollutant load. The security of the water supply has been improved by setting up extensive networks of cross connections between treatment plants, relocation of water intakes and construction of storage basins. Through the establishment of these various administrative agencies and through the development of acceptable techniques, means for control of the pollution situation will become apparent. Continuous control of raw water quality and early detection of occasional pollution are the only effective means. Continuously operating stations have been set up in the Paris area to monitor water quality and detect the arrival of occasional pollution. A plan known as Seine Security has been devised whereby activation of all means of immediate reaction to a pollution problem will occur as soon as an alarm is set off. (Baker-FRC)
W82-02765

RUNOFF AND POLLUTION ABATEMENT CHARACTERISTICS OF CONCRETE GRID PAVEMENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Architecture and Urban Studies.
For primary bibliographic entry see Field 5B.
W82-02801

SECURING SUPPORT FOR NONPOINT POLLUTION CONTROL WITH LOCAL COMPENSATION,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics.
W. Park, and L. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168527, Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University Bulletin 134, August, 1981. 61 p, 5 Fig, 14 Tab, 42 Ref. OWRT-A-085-VA(2).

Descriptors: *Nonpoint pollution control, Planning, Cost distribution, Benefit distribution, Water quality, *Nonpoint pollution sources, *Water pollution control, *Cost allocation, *Occoquan Basin, Fairfax County, Virginia.

In areas designated as having complex water quality problems, the challenge for 208 planning is to develop nonpoint pollution control strategies that are acceptable to the affected political jurisdictions and interest groups. This study's thesis is that acceptance of a nonpoint pollution control strategy by an individual jurisdiction requires the expectation of receiving positive net benefits. The overall objective of this research, therefore, was to investigate how local compensation payments can be used to encourage acceptance of nonpoint pollution control strategies to ensure that no jurisdiction incurs costs in excess of benefits. Using a linear programming (LP) framework that allows the integration of physical, economic, and political aspects of pollution control policy, the report uses Northern Virginia's Occoquan Basin as a case study to illustrate the potential of distributional factors in discouraging acceptance of pollution control strategies that maximize net benefits. Also illustrated within the LP framework is the cost of encouraging acceptance of strategies by allocating nonpoint control according to other criteria. The findings of the research should encourage planners and researchers to consider explicitly the distributional impediments to successful implementation of nonpoint pollution control. The report calls for the development of regional water quality management agencies with authority to raise revenues and offer compensation payments.
W82-02807

EFFECTS OF WHOLE LAKE MIXING ON WATER QUALITY AND PHYTOPLANKTON,
Oklahoma State Univ., Stillwater. School of Biological Sciences.
D. W. Toetz.
Water Research, Vol 15, No 10, p 1205-1210, October, 1981. 7 Fig, 2 Tab, 19 Ref. OWRT-A-078-OKLA(2).

Descriptors: *Water quality management, *Phytoplankton, *Lakes, Mixing, Artificial mixing, Destratification, Dissolved oxygen, *Oklahoma, Biomass, Manganese, Chlorophyll A, Turbidity, Algal growth.

The effects of artificially mixing two Oklahoma lakes for two seasons or more are described. The lakes were mixed with a downflow pump, and changes in water quality and algal biomass were monitored. During 1976, prior to any pumping, the depth of the thermocline in Arbuckle Lake gradually increased during the course of the summer. Artificial pumping during 1977 and 1978 increased the rate at which the depth of the thermocline increased. Pumping advanced turnover of the lake in the autumn of 1977. The thermal profile revealed deeper stratification than had been revealed prior to mixing, but also strong mixing below 10 meters. The volume of the lake containing 1 mg/liter dissolved oxygen or above also increased during the years of mixing; the increase was probably the result of mechanical pumping. The most significant effect of the pump was to decrease ammonia in the epilimnion and hydrogen sulfide in the hypolimnion. In all years the flora was dominated by diatoms, blue-green algae, green algae, and flagellates. The second lake, Ham's Lake, remained destratified due to the pumping, but seldom produced completely isothermal conditions or isochemical concentrations of dissolved oxygen. There was no drastic change in other water quality parameters. However, artificial mixing decreased water clarity and increased algal biomass by a factor of about 2.5, probably by reducing sinking rates of the phytoplankton. Artificial mixing apparently eliminated a fall pulse of Microcystis. (Baker-FRC)
W82-02823

UNSTEADY WATER QUALITY MODEL FOR RIVER NETWORK,
Instituto de Pesquisas Hydraulicas, Porto Alegre (Brazil).
C. E. M. Tucci, and Y. H. Chen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 477-493, October, 1981. 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Water quality management, *Mathematical studies, *River systems, Water quality, Water quality control, Water pollution, Oil industry, Industrial wastes, Mathematical equations, Hydraulic models, Decision making.

A mathematical model designed to predict water quality for a river network under unsteady flow conditions was applied to the Jacui Delta in Brazil. Two of the four rivers feeding the delta are highly polluted, and a third river, receiving the wastes of a petrochemical complex, is in danger of becoming polluted in a few years. Available hydraulic data was used to calibrate the hydraulic part of the model. The model was limited in handling one-dimensional assumptions, but good in handling large river systems at minimal computer costs. The data input can be easily applied to other river systems, while the computer program, which is in modular form, can be easily modified to study other water quality variables. Other researchers have used the hydraulic part of the model with a sediment continuity expression to study water and sediment related problems. Where possible, a model should be calibrated to simulate field conditions. However, where field data is not available, models based on sound physical processes may still be used to evaluate responses of a system to changes and aid in decision making. (Geiger-FRC)
W82-02873

THE APPLICATION OF A WATER-QUALITY MODEL TO THE RIVER WYE, WALES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5A.
W82-02876

ON THE ROLE OF UNDERWATER PARKS AND SANCTUARIES IN THE MANAGEMENT OF COASTAL RESOURCES IN THE SOUTHEASTERN UNITED STATES,
National Park Service, Homestead, FL.
G. E. Davis.
Environmental Conservation, Vol 8, No 1, p 67-70, Spring, 1981. 1 Fig, 1 Tab, 25 Ref.

Descriptors: *Parks, *Underwater, *Coastal zone management, *Coastal waters, Environmental effects, Ecological effects, Commercial fishing, Sport fishing, Consumptive use, Estuaries, Everglades, *Southeastern United States.

The seven underwater parks or sanctuaries in Florida and the US Virgin Islands exhibit wide variations in the degree of protection of aquatic resources. Protection ranges from almost complete protection in the first parks established to almost no protection in the most recently established parks. Coral reef ecosystems are dynamic and change dramatically in response to natural short-term environmental variations such as unusually low temperatures. Fisheries harvests may reduce the size at which exploited species mature, and reduce the amount and variability of genetic material produced by exploited populations. The consequences of permitting consumptive uses of aquatic resources in parks and preserves need to be evaluated. Natural areas must be protected to serve as standards which will allow distinctions to be drawn between effects of exploitation or pollution and normal variation. Unless consumptive uses are severely limited, the primary values of parks and reserves may not be realized. (Small-FRC)
W82-02905

COMPARISON OF STATISTICAL PHOSPHORUS-RETENTION MODELS,
National Board of Waters, Helsinki (Finland).
T. Frisk, J. S. Niemi, and K. A. I. Kinnunen.
Ecological Modelling, Vol 12, No 1, p 11-27, March, 1981. 2 Fig, 9 Tab, 24 Ref.

Descriptors: *Phosphorus, *Water quality management, *Statistical models, *Decision making, *Lakes, Nutrients, Water quality control, Model studies, Mathematical models, Mathematical stud-

ies, Statistical methods, Planning, Management planning, Eutrophication, Eutrophic lakes, Water pollution control.

Statistical phosphorus-retention models may be used in water quality management programs for predicting the average phosphorus levels of a lake. The suitability of a model may be evaluated by comparisons with experimental reference data. Two sets of previously recorded data, one from Lake Paijanne, the other from 85 global lakes, were used in a number of statistical phosphorus-retention models described in the literature. Accessory models were generated from the original models by parameter estimation. Results showed that phosphorus-retention models are not general enough to be accurately applied to any desired lake. The range of these models which should be considered depends upon the relationship between the phosphorus concentration of the outflowing water and the total phosphorus input/volume of lake water. In very eutrophic lakes, where the phosphorus concentration of the outflowing water is over 40 milligrams/cu m, application of the models does not give reliable results. Application of phosphorus-retention models to the estimation of the phosphorus loading capacity of a lake is also considered. (Geiger-FRC)
W82-02930

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ESTIMATION OF CALCIUM SULFATE SOLUTION RATE AND EFFECTIVE AQUIFER SURFACE AREA IN A GROUND-WATER SYSTEM NEAR CARLSBAD, NEW MEXICO,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 2F.
W82-02612

THE COMBINATION OF INPUT-OUTPUT ANALYSIS AND LINEAR PROGRAMMING FOR WATER RESOURCE MANAGEMENT: AN APPLICATION TO NORTHWEST IOWA,
Iowa State Univ., Ames. Dept. of Economics.
J. J. Rhee.
PhD Dissertation, 1980. 180 p, 5 Fig, 26 Tab, 86 Ref, Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-12981.

Descriptors: *Model studies, *Economic aspects, *Water resources development, Linear programming, Systems analysis, Management planning, Water users, Irrigation, Iowa.

The first objective of this study sought to develop an analytical framework integrating both competitive and interdependent dimensions of resource uses. To achieve this objective, a linear programming model that consists of an input-output system and resource constraints, was formulated. The second objective was to apply the model to Northwest Iowa. Because of the difficulty in predicting the future of irrigation in Northwest Iowa, despite an expectation of a substantial increase in irrigation, some upper limits to irrigation were established in terms of land and water availability for irrigation. The results of the application show that the level of final demands that can be achieved subject to the water supply constraints of Northwest Iowa coincided with the target level of final demands that was imposed in the model, implying that the available water supplies of Northwest Iowa do not constitute a limiting factor to achieving the target level of final demands which was based on income and population growth projected for the region to the year 2020. It was concluded that Northwest Iowa as a whole holds potentially sufficient water supplies to depend on for the region's population and economic growth, which is not much out of line with the projection series made by the State of Iowa. The third objective of this study was to suggest an extended model for the future application to state and regions. Based on the resulting model, an impact analysis shows the effects of a change in demand and supply of certain resources on production, resource uses, and income. (Sinha-OEIS)
W82-02734

OPTIMAL WATER REUSE PLANNING,
Texas Univ. at Austin.
G. Ocanas Sanchez.
PhD Dissertation, 1980. 567 p, 59 Fig, 52 Tab, 61 Ref, 4 Append. University Microfilms International, Ann Arbor, MI; Order No GAX81-00950.

Descriptors: *Wastewater treatment, *Water reuse, *Mathematical models, Planning, Economic aspects, Texas, Resource allocation, Model studies.

Current water and wastewater treatment technology allows the reclamation of almost any type of wastewater. Implementing water reuse practices within the framework of water allocation is an important aspect of the planning process. Mathematical models to assess various conjunctive water and wastewater system alternatives are developed. A single period model was first developed to determine the optimal water allocation within the region, and to assess the impact of various legal and environmental restrictions upon the system. This model was then expanded to incorporate the growing nature of the system. The resulting multi-period model considers the capacity expansion of the treatment facilities while assessing the impact of different planning scenarios. The mathematical optimization models consist of both linear and non-linear constraints and a non-linear objective function. The objective of the research was to develop and solve the mathematical planning models. Application of the models is illustrated by a series of hypothetical examples that were solved using the large scale generalized reduced gradient (LSGRG) code. A real world application is also presented using the San Antonio region as the study area. Both LSGRG and successive linear programming with rejection (SLPR) methods were used to obtain solutions to the models. The performance of both solution methods are briefly analyzed. (Sinha-OEIS)
W82-02736

ROBUSTNESS, RELIABILITY, RESILIENCE AND VULNERABILITY CRITERIA FOR PLANNING WATER RESOURCES SYSTEMS,
Cornell Univ., Ithaca, NY.
T. Hashimoto.
PhD Thesis, May, 1980. 125 p, 19 Fig, 10 Tab, 53 Ref, 4 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-20833.

Descriptors: *Water resources development, *Planning, Future planning, Economic aspects, *Economic evaluation.

The ability of a water resource system to serve changing needs over time can be measured using a variety of criteria. The objective of this study is to define some criteria for evaluating possible system performance given uncertain future conditions and the likely variation in inputs and demand, and to show their applicability to specific management problems. For these purposes, robustness, resilience, reliability and vulnerability are defined and quantitative measures of them are given. Some conventional methods of dealing with uncertain and varying events involved in water resources planning are critically reviewed. Discussion on the need for the alternative criteria follow and their relevance and usefulness in water resources systems planning are emphasized. Robustness is defined as an economic measure. It represents variability involved in total costs of a system under uncertain future conditions, and supplements the conventional optimality criterion of cost-effectiveness. Definitions of resilience, reliability and vulnerability are given and quantitative measures are developed and then applied to planning the operation of a water supply reservoir. Conclusions are then drawn on the validity and applicability of the new methodology. (Sinha-OEIS)
W82-02737

ESTIMATION AND OPTIMIZATION OF THE SERVICEABILITY OF UNDERGROUND WATER TRANSMISSION NETWORK SYSTEMS UNDER SEISMIC RISK,
Columbia Univ., New York.
For primary bibliographic entry see Field 8A.
W82-02743

RELIABILITY OF WATER RESOURCES,
Anglian Water Authority (England).
K. F. Clarke, C. Page, and J. S. Brew.
Journal of the Institution of Water Engineers and Scientists, Vol 34, No 1, p 61-73, January, 1980. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Water supply, *Management planning, *Water conservation, *Storage, *Long-term planning, Conservation, Flow discharge, Administration, Operating policies, Drought, Projection, Hydrologic data, Optimization, System analysis, Pumpage, Groundwater, Reservoirs, *United Kingdom.

An alternative method for defining the reliability of water resources is proposed. This method defines reliability in terms of the level of service to consumers, rather than in terms of the frequency of failure. It entails identification of conservation measures for drought periods and estimation of resultant savings; development of an operating strategy and defining a level of risk; and assessment of the level of service when a given output is met. The new method will provide a consistent basis for the planning of water resources and their operation. The use of computer-based mathematical models enables a wide range of levels of service to be calculated. (Titus-FRC)
W82-02749

URBAN CATCHMENT MODELS: A BRIEF EXAMINATION,
George Washington Univ., Washington, DC.
For primary bibliographic entry see Field 4C.
W82-02813

SUPPLEMENT TO PREDICTIVE MODELING OF EFFECTS OF THE PLANNED KINDRED LAKE ON GROUND-WATER LEVELS AND DISCHARGE, SOUTHEASTERN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4A.
W82-02828

MULTIOBJECTIVE ANALYSIS OF IRRIGATION PLANNING IN RIVER BASIN DEVELOPMENT,
Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
S. Vedula, and P. P. Rogers.
Water Resources Research, Vol 17, No 5, p 1304-1310, October, 1981. 2 Fig, 12 Tab, 18 Ref.

Descriptors: *River basin development, *Model studies, Mathematical models, Planning, *Irrigation practices, Irrigation, *Multiobjective planning, *India.

The historical development of a river basin is considered in which extensive irrigation is practiced in the lower reaches of the basin, while an expansion of irrigation development in the upper reaches is proposed. A 12-season (monthly) linear programing model is formulated to evolve optimum cropping patterns in the proposed areas of development. A tradeoff analysis between two conflicting objectives is made by developing the transformation curve for the objectives. The river basin selected for study is the Cauvery River Basin, with a total drainage area of 81,200 square km, located in the States of Kerala, Karnataka, and Tamil Nadu in Southern India. The monthly deterministic model was applied to this four-reservoir system to maximize the net economic benefits and the irrigated cropped area, subject to water, land, and downstream release constraints. The objectives of maximizing net benefits and irrigated cropped area are found to conflict with each other. The transformation curve between the two objectives was developed and the tradeoff was estimated

at the level of irrigation development as proposed by the planning agency. (Baker-FRC)
W82-02855

DEMAND FORECASTING IN WATER SUPPLY NETWORKS,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W82-02926

CASCADED TRADEOFFS: A MULTIPLE-OBJECTIVE, MULTIPLE-PUBLICS METHOD FOR ALTERNATIVES EVALUATION IN WATER RESOURCES PLANNING,
Portland State Univ., OR.
For primary bibliographic entry see Field 6B.
W82-02980

6B. Evaluation Process

THE REED AFFAIR: A CANADIAN LOGGING AND POLLUTION CONTROVERSY,
Waterloo Univ. (Ontario). School of Urban and Regional Planning.
R. Suffling, and G. Michalenko.
Biological Conservation, Vol 17, No 1, p 5-23, January, 1980. 4 Fig, 1 Tab, 40 Ref.

Descriptors: *Social aspects, *Political aspects, *Forest management, Economic aspects, Logging, *Ontario, Canada, Reed Paper Company, Treaties, Environmental effects, Water pollution sources, Mercury, Licenses, *Pulp and paper industry, Water quality, Legal aspects.

Events and biological, economic, and social issues in an Ontario pollution and forestry controversy are summarized. The native Ojibwa people of northern Ontario were given hunting and fishing rights by Treaty 9 (1906) in return for the title to their lands and their allegiance to the government. A controversy arose following the installation of a mercury cell chlor-alkali plant at the Reed Paper Co. mill in 1962. A total of 9000 kg, or 4.5-9 kg per day, of Hg were discharged into the Wabigoon River between 1962 and 1970. Another 13,600 kg are unaccounted for. Although the Hg cell plant was replaced by a permionic membrane process in 1975, the river remains contaminated. Subsequently, forest management practices in Ontario and their effects on the environment (including water quality) were closely examined. It was determined that the tree harvesting schemes proposed by the company would not allow management on a sustained yield basis. The Reed Controversy became a catalyst for political change. The Hartt Commission (The Royal Commission on the Northern Environment) was established to deal with three tasks: determine environmental (social, economic, and cultural) effects of major enterprises north of the 50th parallel, investigate feasibility of alternative uses of natural resources, and suggest means of assessing environmental aspects of major enterprises. (Cassar-FRC)
W82-02605

PROJECT OUTCOMES CORRELATE WITH PUBLIC PARTICIPATION VARIABLES,
Ohio State Univ., Columbus. Dept. of Natural Resources.
R. A. Ellis, and J. F. Disinger.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1564-1567, November, 1981. 1 Tab, 6 Ref.

Descriptors: *Public participation, *Project planning, Public hearings, Administration, Wastewater facilities, *Wastewater management.

The relationship between public participation variables and project outcome variables was analyzed for wastewater treatment projects. Variables were identified from 105 case studies of project planning in wastewater management, water development such as flood control projects, and highway or roads construction. Projects resulting from redistributive policy were associated with undesirable outcomes and tended to have poor information flows. Problems were also experienced by small projects characterized by high social significance. On highly technical projects, it was found to be necessary to educate the public to avoid court battles or other legal actions resulting from misunderstandings. While formal hearings are usually antithetical to good two-way communication, workshops and more informal meetings showed promise of producing successful citizen inputs. (Small-FRC)
W82-02663

ROBUSTNESS, RELIABILITY, RESILIENCE AND VULNERABILITY CRITERIA FOR PLANNING WATER RESOURCES SYSTEMS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 6A.
W82-02737

ESTIMATION OF THE ECONOMIC VALUE OF WETLANDS: METHODOLOGY AND APPLICATION TO SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
C. W. Abdalla, and L. W. Libby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168493, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University Technical Completion Report, September, 1981. 25 p, 1 Fig, 22 Ref, 3 Append. OWRT-A-116-MICH(1).

Descriptors: *Wetlands, *Freshwater marshes, Economic evaluation, Benefits, Costs, Decision making, *Michigan.

Greater understanding and awareness of wetland functions has led to enactment of wetland protection laws in many states. Michigan legislation requires a permit for wetland alteration. Permit decisions are based on the balancing of benefits and costs of proposed wetland uses. Economic concepts are used in this research to structure wetland permit decisions and improve policy choices. Benefit and cost estimation is attempted. A methodology is developed and applied to estimate the value of wetlands in waterfront residential use in southeastern Michigan. The results indicate that location is an important variable influencing development value making estimates site-specific and not generalizable. Strengths, weakness, and limitations of the methodology are assessed. The estimation of development and natural wetland values is a complicated task requiring careful economic analysis and much reliable informational input.
W82-02804

SECURING SUPPORT FOR NONPOINT POLLUTION CONTROL WITH LOCAL COMPENSATION,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W82-02807

PLANNING LEVEL ESTIMATES OF THE VALUE OF RESERVOIRS FOR WATER SUPPLY AND FLOW AUGMENTATION IN NEW HAMPSHIRE,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman.
Water Resources Bulletin, Vol 17, No 4, p 684-690, August, 1981. 7 Fig, 3 Tab, 10 Ref. OWRT-A-050-NH(2).

Descriptors: *Decision making, *Water supply development, New England, *New Hampshire, *Reservoirs, Water supply, Potential water supply, Water resources development, Estimating equations, Estimating.

When projected water use exceeds the safe yield of the existing supply system some decisions must be made. In general, the choice among reservoirs for water supply or flow augmentation is a multi-objective problem. Two of the objectives, the cost per unit of yield and the period of time over which a given reservoir will satisfy projected demand, require estimates of the increase in yield that potential reservoirs will provide. Methods are presented which permit such estimates to be made for direct supply and flow augmentation reservoirs in New Hampshire. An equation is given which can be used to calculate the increase in yield for direct supply reservoirs when the active storage capacity and mean flow at the reservoir site are known. The downstream increase in yield can also be estimated for flow augmentation reservoirs. The required input data for this computation are the active storage and mean flow at the downstream reach. The major uncertainties in the estimates are due to the difficulty in generalizing the influences of operating policies on the relation between regulation and downstream flow distributions. However, these methods appear to provide a rational and empirically supported basis for planning level estimates of the value of reservoirs for water supply and flow augmentation in central New England. (Baker-FRC)
W82-02825

HYDROLOGIC EVALUATION OF A HYPOTHETICAL COAL-MINING SITE NEAR CHRISNEY, SPENCER COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
J. S. Zogorski, D. S. Ramey, P. W. Lambert, J. D. Martin, and R. E. Warner.
Available from the OFSS, USGS Box 25425, Fed Ctr, Denver, CO 80225, Price: $19.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1107, October, 1981. 133 p, 34 Fig, 26 Tab, 32 Ref.

Descriptors: *Evaluation, *Hydrologic data, *Groundwater, *Surface water, Streamflow, Runoff, Coal mines, *Coal mining, Strip mines, Soil horizons, Land use, Water quality, Chemical analysis, Legal aspects, *Indiana, Spencer County, Little Pidgeon Creek, Crooked Creek, Surcace Mining control and Reclamation Act (PL 95-87), Projections.

Protecting the nation's water resources is a major emphasis of the Surface Mining Control and Reclamation Act, PL 95-87. Permanent regulations established for this Act by the Office of Surface Mining (OSM) require the issuance of a permit before mining begins. An application for a mining permit must include an assessment of the hydrologic characteristics of the mining site and adjacent area, and a projection of the potential impacts of mining activities on surface water and ground water. OSM's permanent regulations and guidelines provide little insight on the 'how to' aspect of making the required hydrologic assessment. This investigation was completed to improve the understanding of the kinds of information needed to make such assessments by: (a) reviewing the regulations to determine what hydrologic information is required; (b) preparing an example hydrologic assessment using the regulations as a guideline; and (c) using the experience gained in (a) and (b) to identify areas lacking or needing additional data to make the required assessment. Hydrologic data for the study area were obtained from published and unpublished reports, maps, aerial photographs, personal interviews with residents in the area of the hypothetical mine site, and discussions with experts in the field. Where data were unavailable, 'synthetic' data were generated by extrapolation from proximate or similar watersheds and (or) by assumptions based on experience or theory. A limited amount of field data was collected to corroborate and augment information originating from all these sources. (USGS)
W82-02840

ENVIRONMENTAL IMPLICATIONS AND ASSESSMENTS OF HYDROELECTRIC PROJECTS,
Inland Waters Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 6G.
W82-02896

CONTROL OF A PUMPING STATION BY MINI COMPUTER - A PROGRESS REPORT,
Mouchel (L.G.) and Partners, Bath (England).
C. Martin, and D. King.
Water Services, Vol 85, No 1026, p 409-410, 413-414, 417, August, 1981. 4 Fig, 2 Tab, 1 Ref.

Descriptors: *Control systems, *Computers, *Pumping plants, Automation, Wastewater treatment, *Cost-benefit analysis, Weymouth, *United Kingdom.

The current status of the control system for Radipole Lake Pumping Station is described, including the tendering procedure and cost-benefit analysis. The control system and operating methods are described. The system is based on the Texas Instruments 990/5 micro computer, and a cost-benefit analysis indicates that the control system will pay for itself in five years. All equipment will have manual overrides so operation can continue in the event of a computer failure. Mathematical models of the control system have been developed, and a prediction control program has also been developed. When installed, the system will represent a large fully instrumented catchment and will be usedful in future research projects. (Small-FRC)
W82-02956

COMPUTER MODELING OF FLOOD ALLEVIATION BENEFITS,
Severn-Trent Water Authority, Birmingham (England).
J. B. Chatterton, and E. C. Penning-Rowsell.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR2, p 533-547, October, 1981. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Storm runoff, *Flood protection, *Economic aspects, *Future planning, *Computer models, Model studies, Flood proofing, Decision making, Cost analysis, Computer programs, Hydraulic models, Sensitivity analysis, Bristol, England.

When planning storm drainage or flood protection schemes, it is economically beneficial to evaluate several alternative design standards by computer modeling. A computer model is presented which allows the decision maker to select that calculation of discounted benefits most appropriate to the proposed scheme and the design flood conditions. The computer model incorporates national data on flood damage along with programmable site-specific damage data obtained from surveys or questionnaires. Alternative techniques are also available for relating properties at risk to flood profile information. Optional sub-routines are featured which generate a full discounted cash flow analysis of both scheme cost and benefits. The data sets and the control options fixing the economic and hydrologic assumptions for each assessment may be interchanged to allow for sensitivity analysis. The model may be utilized to evaluate many different design standards with minimum economic errors. The assumptions on calculated benefits most crucial to the final results can be explored in great detail while excluding the less important factors to allow a more comprehensive, accurate and faster evaluation of both structural and nonstructural flood alleviation schemes. Application of the model in Ashton Vale, Bristo, England is illustrated. (Geiger-FRC)
W82-02957

WEST SACRAMENTO CANAL UNIT REFORMULATION,
Bureau of Reclamation, Sacrameto, CA. Mid-Pacific Region.
--Concluding Report on the feasibility investigation, June, 1981. 18 p, 1 Fig, 2 Tab.

Descriptors: *Feasibility studies, *Cost-benefit analysis, *Water resources development, Water supply development, Economic feasibility, Canals, Reservoirs, Water storage, Reservoir storage, *Tehama-Colusa Canal, California.

The 1964 feasibility investigation proposed extending the Tehama-Colusa Canal, then newly under construction, through Yolo County to a terminal reservoir just northeast of Fairfield in Solano County, California. The extension, the West Sacramento Valley Canal, would provide a supplemental water supply to portions of Napa, Solano, and Yolo Counties. An exchange arrangement with Yolo County would also permit Lake County to obtain a supply from the unit. Events occurring after the publication of the 1964 document delayed further work on the ivestigation, but in the late 1970's, interest in the unit was renewed, and a reformulation to update the 1964 plan was initiated. Comparison of benefits and costs indicates that the national economic development plan for the proposed West Sacramento Canal Unit has an unfavorable benefit-cost ratio. While the municipal and industrial portion of the plan is economically justified, the irrigation portion is not. Middletown Dam and Reservoir in Lake County now has an unfavorable economic justification. A need does exist, however, for Central Valley Project (CVP) water storage. Sites Reservoir is capable of conserving surplus flows for later CVP uses, thereby increasing basin water supply efficiency. Extra yield and interim water available while unit needs were increasing could be utilized in the San Joaquin Valley. (Moore-SRC)
W82-02974

SUMMARY; LOWER COLORADO RIVER RECREATION RESEARCH, 1974-1980,
Arizona State Univ., Tempe. Dept. of Leisure Studies.
G. W. Greey, and G. W. Cheatham.
Report prepared for Bureau of Reclamation, August, 1981. 109 p, 67 Tab, 2 Append.

Descriptors: *Colorado River, *Recreation, *Recreation demand, Prediction, Resources management, Water resources development, Camping, Swimming, Boating, Lake Mead, Fishing, Arizona.

This report presents a summary of research data on outdoor recreation use and visitor use patterns within the Lower Colorado River from Pierce Ferry, Arizona, to San Luis on the Mexican border. Each of the ten divisions was studied for a one year period during 1974-77, and a replicate study was completed in 1977-78. The Lake Mead National Recreation Area was studied during the calendar year 1979. Visitor number and recreational activities were quantified by direct observation, and are presented on a quarterly basis for the study/year. Land based activities recorded were: camping, hunting, picnicking, hiking/related, driving for pleasure, motorcycling/horseback riding, off-the-road vehicle use, and other, and water based activities included: swimming/related, fishing, motor boating, water skiing, non-motor boating, canoe/kayak, house boating, tubing, and sailing. There was much variation between divisions, but overall there was a significant increase in visitors, recreation units and recreation participants throughout the lower Colorado River. The activities with the largest percentage increases were driving for pleasure, sailing, canoe/kayak, and picnicking, while house boating, hiking, motorcycling, off-the-road vehicle use and other decreased. The most popular activities in the replication study year were picnicking, camping, swimming/related, motor boating, and driving for pleasure. The information will be used in long-term projections of use, and in management planning. (Brambley-SRC)
W82-02976

CASCADED TRADEOFFS: A MULTIPLE-OBJECTIVE, MULTIPLE-PUBLICS METHOD FOR ALTERNATIVES EVALUATION IN WATER RESOURCES PLANNING,
Portland State Univ., OR.
B. F. Anderson.
Bureau of Reclamation Report, August, 1981, 123 p, 23 Fig, 157 Ref, Append.

Descriptors: *Decision making, *Planning, *Public participation, Water resources development, *Multiobjective planning, Alternative planning, Economic impact, Social impact.

Cascaded Tradeoffs is a method for arriving at an overall ranking of planning alternatives on the basis of public values. The key feature of the method is that it provides for making tradeoffs across both issues, or dimensions of impact, and publics, in a two-step cascade. A scale of commensuration is established on the basis of value judgements from both representatives of the impacted population and agency decision makers. Commensuration is the process of determining what impact on one dimension is equivalent to a given impact on another, or what impact to one public is equivalent to a given impact to another. The method begins by identifying publics across which the greatest value differences occur and within which value differences can be assumed to be negligible. Commensuration is then accomplsihed in two cascaded steps: first across dimensions of impact within each public, in terms of the values of that public; then across publics, on the basis of a judgement by agency decionmakers about a tradeoff dimension. Traditional economic analyses of market values can be helpful in the first step, but not always in the second. There appears to be no generally applicable alternative to human judgement for comparing the values of different publics. The method provides for examination of the extent to which the overall ranking of the alternatives is sensitive to the addition of mitigation measures and to uncertainty in the data. (Moore-SRC)
W82-02980

PROTEIN RECOVERY FROM BEEF PACKING EFFLUENT,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5D.
W82-02994

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST ESTIMATES FOR WATER TREATMENT PLANT OPERATION AND MAINTENANCE.
Public Works, Vol 111, No 8, p 81-83, August, 1980. 5 Tab.

Descriptors: *Cost analysis, *Operation and maintenance, *Potable water, Water quality standards, *Water treatment facilities, Estimated costs.

Information contained in a four-volume report on estimation of water treatment costs (EPA-600/2-79-162a (August)) is presented in summary form. The report considers unit processes and combinations of unit processes that are capable of removing contaminants included in the National Interim Primary Drinking Water Regulations. Conceptual designs are formulated and costs are estimated for each unit process. Estimated cost factors include labor, electrical energy, natural gas, diesel fuel, chemicals, maintenance material, sludge disposal, and amortized capital. Package complete treatment plants, conventional treatment plants, direct filtration plants, reverse osmosis systems, pressure ion exchange softening systems, lime softening systems, pressure filtration plants, and granular activated carbon plants are discussed, and at least one example is presented for each. Corrosion control is also considered. (Small-FRC)
W82-02697

WATER REGULATION IN AN INFLATIONARY ENVIRONMENT,
For primary bibliographic entry see Field 5F.
W82-02701

AN ECONOMIC ANALYSIS OF GROUND WATER MANAGEMENT ALTERNATIVES,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W82-02740

6D. Water Demand

THE COMBINATION OF INPUT-OUTPUT ANALYSIS AND LINEAR PROGRAMMING FOR WATER RESOURCE MANAGEMENT: AN APPLICATION TO NORTHWEST IOWA,

Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 6A.
W82-02734

AN ECONOMIC ANALYSIS OF WATER RESOURCES DEVELOPMENT IN DELTAIC REGIONS OF ASIA: THE CASE OF CENTRAL THAILAND,
Wisconsin Univ.-Madison.
Q-T. Ngo.
PhD Thesis, 1980. 302 p, 20 Fig, 33 Tab, 4 Map, 4 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-15222.

Descriptors: *Water resources development, *Irrigation, *Economic aspects, *Deltas, Agriculture, Saline water intrusion, Flooding, *Thailand.

In the large deltaic regions of Burma, Thailand and Vietnam large rivers which drain the entire basin yearly overflow their banks to flood large tracts of the vast and flat deltas. In the dry season, saline waters from the sea intrude large areas upstream. Water resource development for such an area requires an integrated approach with complementary facilities to distribute and drain water, to store flood flows during the wet season, and to coordinate releases from surface storage for dry season irrigation, for waterway transport, and for repelling saline water at the estuary. When translated in economic terms, the features of this development program dictate the mobilization of enormous amounts of resources for the provision of land improvement infrastructure. A preliminary objective is to analyze the patterns of agricultural development with the purpose of identifying the relevant constraints to growth. Where under heavy population pressure, the arable land frontier has approached exhaustion, intensification of cultivation by raising output per cultivated area may prove to be the most efficient strategy for development. The focus of this study on the importance of irrigation and drainage is only meant to bring out the magnitude of resource requirements needed for the intensification of cultivation in large alluvial plains. (Sinha-OEIS)
W82-02735

WATER FOR INDUSTRY,
Tata Consulting Engineers (India).
B. V. Chitnis.
Aqua, No 2, p 22-24, 1981.

Descriptors: *Water demand, *Water use, *Water resources development, Political aspects, Water supply development, *India, Economic aspects, Governmental interrelations, Government supports, Water quality, Irrigation, Domestic water, Energy, Industrial water.

India is considered well endowed with water supply. Of the current annual supply, 0.16% is used for energy production, 92.5% for irrigation, 1.2% for industrial needs and 6.2% for domestic purposes. In 1975 India withdrew for its total usage about 21% of the probable maximum developable supply. It is expected that in the year 2000 AD, India will use about 54% of the probable maximum, or nearly 68% of the dependable maximum with storage. The percent usage figures for 2000 AD will be 0.5% for non-hydro power, 88.6% for irrigation, 3.6% for industry and 7.3% for domestic purposes. Irrigation is not only the biggest user in terms of quantity, it is also the most powerful user in terms of political leverage. Irrigation returns only 10% of the water it withdraws. The irrigation departments have been pioneers in developing many of the water storage projects in the country. Irrigation has built an extensive water transport network which could be conveniently used by the nonhydro power, industrial and domestic users. Domestic and industrial users are in competition in the larger cities, as their population growth continues to expand rapidly. The recycling of solid water and its subsequent use by either industrial and/or irrigation consumers is being considered for future benefits. Not only must water conservation be increasingly important, a cooperative solution to the treatment of industrial effluents must also be established. The Government's role in the development of water resources will be seen as critical in the coming years as India approaches the limits of the water availability. (Baker-FRC)
W82-02767

GEOLOGY AND WATER AVAILABILITY OF DALLAS COUNTY, ALABAMA,
Geological Survey, Univ., AL. Water Resources Div.
J. C. Scott, H. G. Golden, and J. G. Newton.
Alabama Geological Survey Map 180, 1981. 94 p, 3 plates, 14 Fig, 6 Tab, 30 Ref.

Descriptors: *Available water, *Surface water, *Groundwater, *Water quality, Water yield, Streamflow, Wells, Aquifers, Hydrologic budget, Geohydrology, *Well data, Chemical analysis, Potential water supply, Hydrologic data, Maps, Evaluation, *Alabama, Dallas County.

Geologic units underlying Dallas County, Ala., include deposits in the Upper Cretaceous, Paleocene, Pleistocene, and Holocene Series. The deposits range in thickness from 750 to 2,600 feet and consist of sand, gravel, clay, chalk, sandstone, and limestone. Strata in the Upper Cretaceous and Paleocene Series strike southeastward and dip southwestward 30 to 50 feet per mile. The Alabama River, the largest source of surface water, has an average flow of 17,100 mgd (million gallons per day) and a median low flow of 5,000 mgd at Selma. Other significant sources include the Cahaba River and Mulberry, Pine Barren, Oakmulgee, Boguechitto, and Cedar Creeks. The Gordo and Eutaw Formations, the major sources of ground water, will yield 1 to 2 mgd to individual wells in the northeast part of the county and are potential sources of similar supplies in central and southern parts. Potential sources of large quantities of ground water are the Coker Formation and alluvium and low terrace deposits. Water of suitable quality for most uses is available from streams and aquifers. Water in the Alabama River and Cahaba River is soft and generally contains less than 100 mg/L (milligrams per liter) of dissolved solids. Water in tributary streams draining areas underlain by calcareous deposits is generally moderately hard to hard and contains less than 250 mg/L of dissolved solid. Water in the Eutaw Formation in the southeast part of the county has a chloride content that exceeds 1,000 mg/L, and, in that area, water in the underlying Gordo and Coker Formations is probably sufficiently mineralized to be objectionable. (USGS)
W82-02833

DEMAND FORECASTING IN WATER SUPPLY NETWORKS,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. F. Perry.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY9, p 1077-1087, September, 1981. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Water demand, *Pumping stations, *Forecasting, Model studies, Planning, Water distribution, Kalman filter, Prediction, Networks, Water supply systems, Reservoir operation, Automatic control, *United Kingdom.

An accurate hour-by-hour forecast of water demand is determined with data from an advanced telecontrolled water supply network in the United Kingdom. This type of forecast, more difficult than an aggregate 24-hour forecast, is important for achieving energy savings for reservoir systems which have off-peak pumping stations with variable speed drives. The Kalman filter approach is more attractive than the Karhunen-Loeve spectral expansion method because the state estimates of residuals demand, required for the forecast calculations, can also be used directly for optimal pump control. In addition, the Kalman filter method allows easy updating of the model (15 sec computer time) once parameters have been estimated from historic data (5 min computer time). The spectral expansion method is accurate for the 24-hour prediction period, takes little computer time, and needs only past values of water demand as data. However, it requires substantial storage and completely new calculations for updating on-line pump controls as new observations are received. (Cassar-FRC)
W82-02926

WATER RESOURCES APPRAISALS FOR HYDROELECTRIC LICENSING: ALASKA RIVER BASINS, ALASKA.
Federal Energy Regulatory Commission, San Francisco, CA. San Francisco Regional Office.
Available from the National Technical Information Service, Springfield, VA 22161 as FERC-0068, Price codes: A03 in paper copy, A01 in microfiche. Planning Status Report FERC-0068, Revised January, 1981. 32 p, 4 Fig, 6 Tab.

Descriptors: *Water resources development, *Alaska, *Rivers, *Hydroelectric plants, Federal jurisdiction, Wilderness areas, Wild rivers, National parks, Land use, Cooling water, Planning, River basins, *River basin development.

This revised report presents updated information on the water resources of the river basins of Alaska, and information on new and planned developments. There are 20 hydroelectric projects, existing or under construction, with a total installed capacity of 157,780 kw. An additional 10 projects are in the preliminary and planning stages. Large areas of Alaska have been placed under wilderness protection (56.4 million acres), and national parks or wildlife refuges (49 million acres), and 25 streams have been added to the National Wild and Scenic Rivers System, with a further twelve to be considered. Of the 98 potential hydroelectric power projects, 15 have potential conflicts with the Federal lands designations, and their development would seem to be impossible. The environmental impacts of other developments are not known and may be significant. There is considerable potential for pumped storgage hydroelectric and tidal power development, but practical factors, environmental impacts, and lack of markets render development impractical. Cooling water requirements for steam-electric generating plants are projected to be 431 mgd withdrawn and 7 mgd consumed by 2000. (Brambley-SRC)
W82-02975

6E. Water Law and Institutions

A PRELIMINARY SURVEY OF STATE GROUND-WATER LAWS,
National Center for Ground Water Research, Oklahoma City, OK.
G. Wickersham.
Ground Water, Vol 19, No 3, p 321-327, May/June, 1981. 1 Tab, 15 Ref.

Descriptors: *Water law, *State jurisdiction, *Groundwater management, Water policy, Legal aspects, Arizona, Water management, Water conservation, Regulations, Permits, Well permits, Water quality standards, Water quality control.

A survey of groundwater laws in 24 states showed several control measures common to many states--licensing of water well drillers, requirement of well permits before drilling, and establishment of groundwater management districts. Four states and Guam have groundwater quality standards. New York has the most complete list of chemical parameters, 83. New Jersey sets stricter limits for the Central Pine Barrens than for other areas of the state. Western states are active in new comprehensive groundwater legislation. No one law can be used as a model for all states because hydrology and development are so variable. However, Arizona's new groundwater laws are nearly a model. The 1980 Groundwater Management Act created a statewide management and conservation program, to be implemented over 5 years. It requires registration of all water wells and filing of annual pumpage reports. The four driest regions have a pump tax, mandatory conservation for farmers and industry, and per capita consumption limits for cities. No new irrigated agriculture is allowed. The goal is safe yield by 2025. (Cassar-FRC)
W82-02616

SECONDARY TREATMENT WAIVERS ISSUED, CONTROVERSY CONTINUES,
C. Dalpra.
Journal of the Water Pollution Control Federation, Vol 53, No 11, p 1554-1557, November, 1981. 1 Tab.

Descriptors: *Legal aspects, *Secondary wastewater treatment, *Wastewater facilities, *Coastal waters, Water quality standards, Environmental effects, Environmental protection, Ocean dumping, Pacific Ocean.

Controversy over the United States Environmental Protection Agency's waivers of secondary treatment to six communities discharging wastes and wastewater into the Pacific Ocean is discussed. The EPA has had to make these decisions with little historical or environmental procedent. Some opponents of the program feel it is too lax, while others find it too restrictive. The General Accounting Office has criticized the program, stating that hundreds of communities have been prevented from applying for waivers because of restrictive EPA regulations and Congressional legislative restraints. The report estimated a potential savings of up to $10 billion if waivers were granted to the 846 communities within one-half mile of a coastline. Recent litigation may force the EPA to reopen the waiver application process. (Small-FRC)
W82-02652

WATER POLLUTION CONTROL IN THE FEDERAL REPUBLIC OF GERMANY,
H. Hornef.
Aqua, No 2, p 11-16, 1981. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Germany, *Water pollution control, *Legal aspects, Governmental interrelations, Political aspects, Sanitation, Wastewater treatment, Effluents, Clarification, Industrial effluents.

The water resources policy of the Federal Republic of Germany places foremost emphasis on water pollution control. Its objectives are to maintain or re-establish the ecological balance of waters, to maintain secure water supplies to the population and industry, and to preserve on a long term basis other uses of water resources serving the public welfare. The Federal Government has the overall power to enact laws concerning management of water resources. Various legal instruments were established during the 1970's to provide for more efficient water pollution control. Although efforts have been made, the poor quality of several reaches of waters, including the Rhine, continues to speed efforts for improvement. The use of recycled water by industry and public power utilities is increasing. One of the major tasks at hand is the reduction of the pollution load on waters caused by biodegradable substances. In addition to the encouraging developments in the construction of clarification plants, it has become increasingly obvious that selective retention of critical pollutants must be pursued. Finally, water pollution control must be directed toward preventing the formation of harmful effluents from the outset. Development work must continue on pollution-controlled manufacturing processes and products. The problem of pollutants can only be solved if even closer and more trusting cooperation is attained between public authorities and industry, particularly the chemical industry. (Baker-FRC)
W82-02766

LEGAL QUESTIONS AND PROBLEMS OF KANSAS GROUNDWATER MANAGEMENT DISTRICTS,
Kansas Water Resources Research Inst., Manhattan.
J. C. Peck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168477, Price codes: A04 in paper copy, A01 in microfiche. Contribution No 218, September, 1980. 53 p. OWRT-A-099-KAN(1), 14-34-0001-0118.

Descriptors: Water management, *Water law, Water policy, Water allocation, Groundwater management districts, *Kansas, Legal aspects.

The 1972 Kansas Groundwater Management District Act provided a mechanism for local control of groundwater resources. The five groundwater management districts (GMD's) established to date are following the statutory procedure of establishing management programs and recommending rules and regulations to the Chief Engineer of the Division of Water Resources of the State Board of Agriculture, the key water rights administrator of the state. The enabling act itself may have a constitutionality problem because of Art. 2, S 21 of the Kansas Constitution which provides that matters of local legislation may be conferred on political subdivisions by the legislature. Groundwater problems, being larger than a local concern, might be deemed to be in the purview of the legislature, not local units of government. The right granted the Chief Engineer to declare 'intensive groundwater use control area' within GMD's, insofar as he may shut down appropriators without regard to priority dates, may have consistitutional problems. GMD's may sue and be sued, but they should have express statutory causes of action before they can bring the suit. Thus, only the Chief Engineer is able to bring suit for a violation of the regulations, notwithstanding sections in these regulations that purport to give GMD's that power. GMD's may sue to enforce 'policies and standards' of the GMD. The well spacing, safe yield and depletion regulations passed to date may be contested by unsuccessful permit applicants on several grounds. To insure their validity, the GMD's should be sure that the various figures used in the requirements have a supportable basis.
W82-02802

MANAGING CRISIS: THE EFFECTIVENESS OF LOCAL DISTRICTS FOR CONTROL OF GROUND WATER MINING,
Colorado Univ., Denver. Graduate School of Public Affairs.
For primary bibliographic entry see Field 4B.
W82-02819

HYDROLOGIC EVALUATION OF A HYPOTHETICAL COAL-MINING SITE NEAR CHRISNEY, SPENCER COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 6B.
W82-02840

NEW DEVELOPMENTS IN PAPERMAKING IN WESTERN EUROPE,
Technical Univ. of Denmark, Copenhagen. Inst. fuer Papierfabrikation.
For primary bibliographic entry see Field 5D.
W82-02947

DIGEST OF WATER RESOURCES POLICIES AND AUTHORITIES.
Office of the Chief of Engineers (Army), Washington, D.C.
Pamphlet No 1165-2-1, March, 1981. 268 p, 5 Tab.

Descriptors: *Legal aspects, *Public policy, *Water resources development, *Construction, Civil engineering, Water supply, Water quality, Wildlife, Conservation, Navigation, Flood control, Erosion control, Hydroelectric power, Recreation, Wetlands, Environmental effects.

It is the policy of the Corps of Engineers to develop, control maintain, and conserve the Nation's water resources in accordance with the laws and policies established by Congress and The Administration. Actions taken comply with all relevant environmental statutes, have no significant safety problem, and are in the overall public interest. A summary is presented of the existing administrative and legislative water resources policies and authorities pertinent to the civil works activities of the Corps. The Federal responsibility in water resources; legislative, executive, judicial roles and policies; general policies; management of the civil works program; planning investigations; report preparation, processing and project authorization; programming, budgeting and appropriations; post authorization studies and engineering design; construction; and operations, maintenance and project management are aspects of the Corps programs. Corps civil works projects include those concerning navigation, flood damage reduction, beach erosion control, hurricane protection, stream bank erosion control, hydroelectric power, recreation, water supply and quality management, fish and wildlife conservation, wetlands conservation, and aquatic plant control. The Corps also has regulatory functions concerned with navigable waters and the disposal of dredged or fill materials into the waters of the U.S. (Moore-SRC)
W82-02973

6F. Nonstructural Alternatives

TO INHIBIT OR NOT TO INHIBIT: THAT IS THE QUESTION,
For primary bibliographic entry see Field 5A.
W82-02672

6G. Ecologic Impact Of Water Development

THE ENVIRONMENTAL EFFECTS OF HYDROELECTRIC PROJECTS,
G. F. Kenyon.
Canadian Water Resources Journal, Vol 6, No 3, p 309-314, 1981.

Descriptors: *Hydroelectric power, *Environmental effects, *Water level fluctuations, Water resources development, Dam effects, Reservoir operation, Wildlife habitats, Fish barriers, Social impact, Water quality, Recreation facilities, Fluctuations, Scour, Flood damage, Forests.

The advantages of hydroelectric power--simple, renewable, and nonpolluting--must be balanced against the environmental impacts, particularly of large projects. Flooding behind a dam takes fertile bottomland out of production; destroys prime forest land; disturbs wildlife, fish, and human habitats; increases water temperature; changes water quality; and inundates scenic rivers. Fluctuating water levels and changes in flow regimes during operation of a hydroelectric station create a dead littoral zone around the reservoir, drown forests, affect recreational use, disturb waterfowl nesting sites, cause scour and flushing downstream, and can produce nitrogen supersaturation in thespillway area. Small hydroelectric projects may retain many of the benefits without the unfavorable environmental effects produced by megaprojects. (Cassar-FRC)
W82-02632

ON THE ALGAL ECOLOGY OF THE LOWLAND IRAQI MARSHES,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
B. K. Maulood, G. C. F. Hinton, B. A. Whitton, and H. A. Al-Saadi.
Hydrobiologia, Vol 80, No 3, p 269-276, 1981. 3 Fig, 4 Tab, 20 Ref.

Descriptors: *Marshes, *Algae, Phytoplankton, Tigris River, Euphrates River, *Iraq, Deltas, Diatoms, Water quality, Cyanophyta, Epiphytes, Chlorophyta, *Ecology.

The marshes of the Tigris-Euphrates delta, Iraq, little changed in recent historical times, now face environmental effects from drainage projects, three dams, reed-harvesting, water transfers, and oil field development. A documentation of the algal community in boat channels during February 1978 and September 1979 showed that epiphytes, especially the filamentous type, were abundant. Filamentous green algae were more common in February, and blue-greens in September. Diatoms dominated the phytoplankton. Planktonic blue-green algae were mainly coccoid form; bloom-formers were rare. Heterocystous blue-green algae from boat hulls showed distinct laminations made of different species. Water in this region was slightly saline (0.2 0/00 to 1.33 0/00), varied widely in temperature (15 to 28.5 C), and was relatively turbid, calcerous,

and mesotrophic with respect to P and N. (Cassar-FRC)
W82-02777

TECHNICAL AND ECOLOGICAL IMPACTS OF THE HIGH ASWAN DAM,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W82-02856

ENVIRONMENTAL IMPLICATIONS AND ASSESSMENTS OF HYDROELECTRIC PROJECTS,
Inland Waters Directorate, Ottawa (Ontario).
P. J. Reynolds, and S. H. Ujjainwalla.
Canadian Water Resources Journal, Vol 6, No 3, p 5-19, 1981. 35 Ref.

Descriptors: *Hydroelectric plants, *Environmental effects, Planning, Monitoring, Ecological effects, Forests, Fish, Wildlife, Recreation, *Canada, *Cost-benefit analysis, Social impact, Water quality, Transmission lines, *Water resources development.

Hydroelectric power development can be compatible with the environment if projects are planned properly with input from the public and government agencies. Possible benefits of power development are construction of roads, communications, and services; new jobs and industry; possible opportunities for hunting and fishing; reforestation; increases in tourist activities; and building of new communities. The many 'disbenefits' include damage of fishing, wildlife, forests, shorelines, and water quality; flooding; recreational losses; dislocation of people; and disturbance by high voltage transmission lines. Even after 10 years of formal environmental impact assessments in Canada problem areas remain: (1) inadequate analytical techniques, (2) lack of assessment review procedures and manuals, (3) hurried environmental assessment reviews, and (4) absence of a detailed monitoring program supervised by a regulatory agency. It is suggested that cost-benefit analyses of environmental investigations be conducted. (Cassar-FRC)
W82-02896

HYDROACOUSTIC SURVEYS OF FISH ABUNDANCE AND DISTRIBUTION IN TWIN LAKES, COLORADO,
Washington Univ., Seattle. Coll. of Fisheries.
R. E. Thorne, and G. L. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-122250, Price codes: A02 in paper copy, A01 in microfiche. Water and Power Resources Service Report REC-ERC-81-4, April, 1981. 19 p, 8 Fig, 3 Tab, 15 Ref.

Descriptors: *Trout, *Fish populations, *Spatial distribution, *Pumped storage, Hydroelectric plants, Environmental effects, Reservoirs, Preimpoundment, Limnology, Juvenile growth stage, *Twin Lakes, Colorado.

Twin lakes are a pair of montane drainage lakes of glacial origin located on Lake Creek in central Colorado. The northwest corner of the lower lake is the site of the Mt. Elbert Pumped-Storage Powerplant, which is scheduled to begin operation during 1981. Water will be pumped from the lower lake up into a newly constructed forebay reservoir. A scheduled increase in the water surface elevation will inundate the isthmus between the two lakes, creating one larger reservoir. Concern exists over the effects of the powerplant on the ecology of the lakes, and especially on lake trout. Hydroacoustic surveys were conducted on Twin Lakes during September 1980 in order to measure the size and distribution of the resident fish population. Two distinct size groups of fish were observed: large fish below the thermocline (about 12 m) and small fish in the epilimnion. Net samples indicated that the large fish were predominately lake trout. Their estimated population size was 14,600, with 95% confidence limits of 4,100 to 25,000. The relatively large confidence intervals were the result of the relatively low fish density and its contagious distribution. The small fish were not identified, but may have been juvenile lake trout. Data presented in this report will be used along with those collected from other preoperational studies at Twin Lakes to form a pool of information for comparison with data collected following commencement of powerplant operations. (Moore-SRC)
W82-02977

WATER QUALITY OF THE PROPOSED NORDEN RESERVOIR, NEBRASKA, AND ITS IMPLICATIONS FOR FISHERY MANAGEMENT,
Bureau of Reclamation, Denver, CO. Lower Missouri Region.
J. W. Yahnke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-149345, Price codes: A04 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-81-8, May, 1981. 56 p, 6 Fig, 7 Tab, 62 Ref, Append.

Descriptors: *Eutrophication, *Dissolved oxygen, *Reservoirs, *Water quality, *Environmental effects, Thermal stratification, *Fisheries, Cyanophyta, Reservoir releases, Simulation, Model studies, Nutrients, *Norden Reservoir, Nebraska.

After the filing of the Final Supplement to the Environmental Impact Statement on the O'Neill Unit, the Environmental Protection Agency expressed concern over the potential for excess productivity in Norden Reservoir, a major feature of the O'Neill Unit, and consequent hypolimnetic oxygen depletion in the reservoir if it should become thermally stratified for an extended period of time. A combination of nutrient loading models and a temperature simulation model were used to project the trophic state, productivity, and duration of stratification of the reservoir. The trophic state index indicated that the reservoir would be eutrophic; the estimated mean annual chlorophyll a concentration indicated a high likelihood that algal blooms would occur. A classification function was applied to the reservoir to evaluate whether the blooms would consist of blue-green or nonblue-green algae. The results show a 98% probability that blue-green algal blooms will occur. Dissolved oxygen curves for the reservoir were then developed for the period immediately prior to fall overturn. Curves were developed based on a reservoir with similar nutrient loadings and on theoretical curves. From these and the temperature model, oxygen concentrations in the reservoir discharge were estimated. The dissolved oxygen may be sufficient to support aquatic life but may fall below the Nebraska standard under certain circumstances. The reservoir and the river downstream are expected to support a cold-water fishery; most species now present in the river will be eliminated. The methods developed for this study may have application to other impoundments where an analysis is required to answer questions concerning the potential for such problems. (Moore-SRC)
W82-02983

RESULTS OF FISHERIES INVESTIGATIONS AT TWIN LAKES, COLORADO; 1973-76,
Colorado Div. of Wildlife, Fort Collins. Research Center.
L. M. Finnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-145129, Price codes: A04 in paper copy, A01 in microfiche. Bureau of Reclamation, Report REC-ERC-80-5, August, 1981. 52 p, 21 Fig, 8 Tab, 25 Ref, 4 Append.

Descriptors: *Pumped storage, *Trout, *Environmental effects, *Lake fisheries, Sport fishing, Crustaceans, Hydroelectric plants, Supersaturation, Limnology, Turbines, Fish food, Turbidity, *Twin Lakes, *Colorado.

Construction and operation of the pumping-generator plant project at Twin Lakes, as well as the enlargement of the lakes, could have detrimental effects on the sport fishery in the lakes. Preoperational studies were conducted at Twin Lakes during 1973-1976 to estimate fisherman use and harvest of both naturally reproduced lake trout, and stocked creel-sized rainbow trout; and to document relative abundance and spatial distribution of lake trout and opossum shrimp (Mysis relicta). An estimated 100,000 man-hours of fishing effort were expended yearly during the summer, with an additional 4000-5000 hours recorded on the lower lake in December-January. Game fish harvest ranged from 25,000 to 43,000 rainbow trout and 1200-1500 lake trout over 380 mm long. Gill-netting operations conducted during May, August, and November 1974-1975 revealed no significant differences in lake trout abundance between months or years, but a majority of the lake trout were captured from depths exceeding 15 m. Monthly benthic trawls for opossum shrimp during ice-free months showed that mean population numbers increased over the summer from 20/sq m to a peak of 96/sq m in late August to early September. Powerplant operations may result in a loss of game fish through the pump-turbines, and a loss through the Twin Lakes Dam outlet works. There may be a buildup of gases in the water during generating cycles, which could cause heavy fish mortality. Operation of the powerplant may also change the lake temperature and increase the turbidity. (Moore-SRC)
W82-02984

7. RESOURCES DATA

7A. Network Design

STATISTICAL CONSIDERATIONS AND SAMPLING TECHNIQUES FOR GROUND-WATER QUALITY MONITORING,
Louisiana Technical Univ., Ruston. Dept. of Agricultural Engineering.
J. D. Nelson, and R. C. Ward.
Ground Water, Vol 19, No 6, p 617-625, November/December, 1981. 1 Fig, 22 Ref.

Descriptors: *Monitoring, *Sampling, *Statistical methods, Water quality, Water sampling, Groundwater.

Statistical techniques are incorporated into groundwater sampling to obtain the optimum information from a minimum number of samples for both special studies and routine monitoring. The optimum number of required samples is based on a specified confidence interval about the mean of the variable under consideration. If the observations are independent in space and time, the number of samples can be determined. However, if the samples are spatially or serially correlated, the sample size must be increased to obtain the same amount of information that would be obtained in uncorrelated observations. The advantages and disadvantages of several sampling techniques are discussed. Simple random sampling can be applied to sampling in space and in time. The population must be defined according to the objective of the study. The primary use of systematic sampling is sampling in time, because it collects a sample every certain number of units or every designated interval. In cases of periodic variation the sampling interval must be carefully chosen to give reliable results. In stratified random sampling the total population is divided into nonoverlapping subpopulations, referred to as strata. This stratification may be by area, time, or season. The variance for simple random sampling is greater than for systematic or stratified random sampling. For serially correlated populations stratified random sampling is better than simple random sampling. Systematic sampling is more precise than stratified random sampling in some cases, possibly in groundwater monitoring. (Cassar-FRC)
W82-02618

HOW ABIOTIC FACTORS AFFECT THE DISTRIBUTION OF TWO SPECIES OF TROPICAL PREDACEOUS AQUATIC BUGS (FAMILY: NAUCORIDAE),
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
R. J. Stout.
Ecology, Vol 62, No 5, p 1170-1178, October, 1981. 6 Fig, 8 Tab, 9 Ref.

Descriptors: *Aquatic insects, *Population dynamics, *Flood flow, Flow velocity, Streamflow, Flood discharge, Natural streams, Costa Rica.

This study of contrasting Costa Rican stream sites determined how two types of stream hydrolocoris insularis Chapman and Cryphocricos latus Usinger. The two streams, the Sabalo and the Sura, had different maximum velocities and direction of flow during floods,different flood frequencies, different flood substrata type, and different mobility of substrata during floods. Backflooding in the Sura had no subsequent effect on the abundance or distribution of either species. In the Sabalo, nymphal populations of L. insularis decreased significantly after a spate because of loss of numbers and loss of previous habitat. Nymphs and adults of C. latus were more abundant under conditions of fast currents, large rocks, and coarse-grained pebbles. Population distribution patterns for the two species were explained by differences in flooding characteristics of the streams. (Small-FRC)
W82-02633

7B. Data Acquisition

MICROWAVE MEASUREMENTS OF SNOWPACK PROPERTIES,
Kansas Univ./Center for Research, Inc., Lawrence.
For primary bibliographic entry see Field 2C.
W82-02646

REMOTE DETECTION OF NUTRIENT AND WATER DEFICIENCIES IN SUGARCANE UNDER VARIABLE CLOUDINESS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
R. D. Jackson, C. A. Jones, G. Uehara, and L. T. Santo.
Remote Sensing of Environment, Vol 11, No 4, p 327-331, September, 1981. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Remote sensing, *Sugarcane, *Nutrients, Infrared radiation, Water stress, Cloud cover, Irradiance, Potassium, Nitrogen, Vegetation.

Nitrogen, potassium, and water deficiencies in sugarcane crops were detected by spectral measurements in the infrared band (0.76-0.90 microns) and red band (0.63-0.69 microns) taken with a radiometer mounted on a 4 meter aluminum pole. The infrared/red ratios of a well nourished and adequately watered sugarcane field (averaged 17.4) were significantly higher than those measured over a N-deficient plot (9.3), a K-deficient plot (16.2), and a waterstressed plot (15.1). Although radiance values varied by a factor of 5 in both bands over a range from direct sunlight to full shade, the infrared/red ratios under the same conditions were fairly constant, 15.8-16.5. This technique is reliable only after the ground is completely covered with vegetation, usually 3 to 4 months after planting. (Cassar-FRC)
W82-02709

WATER MANAGEMENT IN THE NORTH DESCHUTES UNIT IRRIGATION DISTRICT: GEOGRAPHIC PERSPECTIVES AND REMOTE SENSING APPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geography.
M. D. Nellis.
PhD Thesis, 1980. 270 p, 24 Fig, 34 Tab, 99 Ref, 12 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-18944.

Descriptors: *Water management, *Irrigation, *Remote sensing, Aerial photography, Infrared imagery, Irrigation districts, *Oregon, Thermal infrared imagery, Color infrared photography.

The North Unit Irrigation District of Central Oregon is characterized by limited water and the need for efficient utilization and control of the irrigation system. The primary objective of this research was to determine the practicality of utilizing thermal infrared imagery and color infrared photography for assessing irrigation water management problems. A field survey of the area covered by the overflights was used to map patterns of fields and irrigation methods. Data gathered through farm interviews, ground-based measurements, and imagery and aerial photographic interpretation were statistically treated. The results of this research demonstrate the practicality of using thermal infrared imagery and color infrared photography for detecting problems associated with the irrigation water management system. The thermal infrared imagery was useful for detecting canal leakage, non-uniformity of water distribution at all stages of crop growth, and apparent crop canopy temperatures as an indicator of crop stress. The color infrared photography was useful for detecting crop stress resulting from a variety of field conditions. (Sinha-OEIS)
W82-02739

RECONNAISSANCE OF THE HOT SPRINGS MOUNTAINS AND ADJACENT AREAS, CHURCHILL COUNTY, NEVADA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 1A.
W82-02830

CALCULATION OF THE ANNUAL DISTRIBUTION OF RIVER RUNOFF WHEN OBSERVATION DATA ARE AVAILABLE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2E.
W82-02854

THE USE OF DIALYZING SACKS IN ESTIMATION OF PRODUCTION OF BACTERIOPLANKTON AND PHYTOPLANKTON,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Plant Systematics and Ecology.
L. G. Toth.
Archiv fur Hydrobiologie, Vol 89, No 4, p 474-482, August, 1980. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Phytoplankton, *Bacteria, *Productivity, Dialyzing sacks, Plankton, Zooplankton, Population dynamics, Incubation, Mortality, Predation, Lakes, *Lake Balaton, *Hungary.

Semipermeable dialyzing sacks and glass bottles were compared as means of estimating production of pelagic microflora in Lake Balaton, Hungary, during the summer of 1978. The glass bottle technique produced underestimates of 6.9% in bacterial cells alone, 60.0% in colonized bacteria, 45.5% in total bacterioplankton, 27.2% in microalgae, 42.4% in algae larger than 10 microns, and 40% in total phytoplankton. The matter balance of phytoplankton was determined for the period between 10 a.m. and 4 p.m. as follows: loss to predation, 11.1%; residual mortality, 27.4%; fraction of biomass appearing in actual biomass, 61.5%. The matter balance of bacterioplankton was as follows: loss to predation, 10.1%; residual mortality, 67.5%; and fraction appearing in actual biomass, 22.4%. A schematic representation of the matter-energy flow system between the phytoplankton and bacteria is depicted. (Cassar-FRC)
W82-02866

INSTRUMENTATION FOR AERATED FLOW ON SPILLWAYS,
Ministry of Energy, Wellington (New Zealand). P. Cain, and I. R. Wood.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1407-1424, November, 1981. 11 Fig, 2 Tab, 13 Ref.

Descriptors: *Spillways, *Measuring instruments, Aeration, Dams, Aviemore Dam, New Zealand, Bubbles.

A study was made of instruments used for measuring air concentration and velocities in self-aerated flow on the spillway of Aviemore Dam. Self-aeration in open channel flow is the natural phenomenon whereby atmospheric air is drawn into and mixed with the water, creating a characteristic white appearance. Measurements in very aerated regions of flow on the spillway of Aviemore dam indicate that surface regions are very highly aerated, with air concentrations in the range of 0.5 to 0.9 (defined as the volume of air/unit volume). Largest bubbles in this surface region are about 10 mm - 20 mm in diameter. Away from the surface the flow is less aerated and bubbles are smaller. Methods for measuring stagnation pressure and air concentration are considered. Descriptions are offered of the operation of a bubble size probe and a correlation velocity probe. The most accurate and reliable measurements obtained at Aviemore were those made using the conductivity portion of the combined probe for air concentration and the correlation probe for velocity. However, in future measurements a single resistivity probe would be used for air concentration. (Baker-FRC)
W82-02880

CONSTRUCTION OF A GAMMA-DISTRIBUTION PROBABILITY PAPER FOR STRAIGHTENING DISCHARGE PROBABILITY CURVES,
F. F. Razzorenov.
Hydrotechnical Construction, No 5, p 471-474, May, 1980. 3 Fig, 2 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 5, p 23-25, May, 1980.

Descriptors: *Probability distribution, *Hydrologic data, *Flow discharge, Flow rates, Mathematical studies, Discharge measurement, *Streamflow forecasting, *Discharge hydrographs.

The Hazen probability method used to plot discharge probability curves makes it possible to represent the probability curve as a straight line only in the case of a normal distribution of the series. When the data are skewed, the curve is bent. For skewed data, a special gamma-distribution probability method should be used. With this method, it is possible to present the probability curve as a straight line for any values of the coefficeints of variation and skewness. The gamma-distribution method is particularly useful for hydrologic data, as data for large discharges are almost always skewed. Probability curves are presented for the maximum discharges of the Kura River at Likani Village plotted using the Hazen method and the gamma-distribution method. The gamma-distribution method is judged more successful. (Small-FRC)
W82-02925

A RATE OF RISE CONTROLLER FOR AUTOMATIC WATER SAMPLERS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Forest Research.
E. M. O'Loughlin.
Journal of Hydrology, Vol 50, No 1-3, p 383-387, March, 1981. 1 Fig, 1 Ref.

Descriptors: *Sampling, *Water sampling, *Control systems, *Automation, Water quality, Streams.

A controller was developed to actuate an automatic water sampler for streams such that the sampling interval increases in direct proportion to the rate of change of water level and is independent of absolute discharge. This results in more frequent sampling during periods of more variable water quality. The controller features simple construction, low power consumption, variable sensitivity, and low cost. (Cassar-FRC)
W82-02938

EVALUATION OF REMOTE SENSING DATA FOR INPUT INTO HYDROLOGICAL SIMULATION PROGRAM-FORTRAN (HSPF),
Hydrocomp, Inc., Mountain View, CA.
D. D. Franz, and S. M. Lieu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-209561, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-81-037, July, 1981. 2 p.

Descriptors: *Hydrologic models, *Remote sensing, *Satellite technology, *Computer models,

Model studies, Simulation, Land use, Flow rate, Water temperature, Dissolved oxygen.

Remotely sensed data from the LANDSAT satellite and conventionally obtained data were used to set up the input parameters of HSPF. Simulations were then run to compare the model outputs from the two sets of input data. The remotely sensed data set performed at least as well as the conventional one when model results were compared with observed data. Differences in land-use distribution had little effect on the overall outcome of HSPF modeling. Both the conventional and the remotely sensed parameter sets performed well for certain simulations. The results for flow rate, water temperature, and dissolved oxygen are comparable to observed data. Neither parameter set seemed to perform well in nutrient simulations. Assessing the accuracy of these results, however, was difficult because of inadequacies in the observed data and the modeling approach. Refinement of information on urban and water areas in the remotely sensed land-use classification would result in better segment definition. Use of a remotely sensed database offers significant savings in cost (about 30 to 50%) in comparison with use of a conventional database. A remotely sensed database offers advantages of repeatability, relative rapidity and ease of information collection. It would be particularly advantageous in large or inaccessible areas or in areas requiring frequent database updates. The Image Based Information System (IBIS) used to manipulate the Landsat data was found to contribute significantly to the data collection and handling process. (Moore-SRC)
W82-02986

7C. Evaluation, Processing and Publication

LOW-FLOW CHARACTERISTICS OF KENTUCKY STREAMS, 1980,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W82-02826

MISCELLANEOUS SURFACE-WATER DATA, PECOS RIVER BASIN, NEW MEXICO,
Geological Survey, Pasco, WA. Water Resources Div.
C. C. Cranston, G. E. Kues, and G. E. Welder.
Geological Survey, Open-File Report 81-218, February, 1981. 8 p, 1 Fig, 1 Tab.

Descriptors: *Surface water, *Surface runoff, *Hydrologic data, Tributaries, Streamflow, Discharge measurement, Springs, Canals, Pumping, *New Mexico, *Pecos River basins, Mapping.

Miscellaneous surface-water data from the Pecos River basin of New Mexico are assembled into one table. Measurements and estimates of the discharge of streams, springs, and diversion canals and pumps that are not readily available to the public are given. The principal sources of information are published and unpublished reports and various records of the U.S. Geological Survey and the New Mexico State Engineer Office. Many thousands of surface-water discharge values are given. (USGS)
W82-02827

DRAINAGE AREAS OF STREAMS AT SELECTED LOCATIONS IN KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
D. E. Bower, and W. H. Jackson.
Geological Survey Open-File Report 81-61, 1981. 118 p, 1 Fig, 12 Tab.

Descriptors: *Hydrologic data, *Surface water, *River basins, *Drainage area, Streams, Streamflow, Sites, Sinks, *Kentucky, Ohio River basin, Lower Mississippi River basin, Watersheds.

The drainage areas for more than 2,000 selected sites throughout Kentucky were determined. Areas of limestone terrain characterized by sinkholes are indicated in basins where they have been determined. Each location is referenced by U.S. Geological Survey station number (where assigned), latitude, longitude, county code, topographic quadrangle, river distance, and in some cases by nearby town or landmark. All values are given in both English and metric units and an alphabetical index by stream name is provided. (USGS)
W82-02835

POTENTIOMETRIC SURFACE MAPS OF THE SPARTA SAND: NORTHERN LOUISIANA AND SOUTHERN ARKANSAS, 1900, 1965, 1975, AND 1980,
Geological Survey, Alexandria, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W82-02839

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1980.
Geological Survey, Anchorage, AK. Water Resources Div.
Geological Survey Water-Data Report AK-80-1, 1981. 373 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Alaska.

Water resources data for the 1980 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 114 gaging stations, stage only record for 1 gaging station, water quality for 55 stations, and water levels for 33 observation wells. Also included are 56 low-flow, 8 crest-stage, and 2 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (USGS)
W82-02845

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1980--VOLUME 1. MISSOURI RIVER BASIN.
Geological Survey, Cheyenne, WY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-153024, Price codes: A99 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report WY-80-1, 1981. 621 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Wyoming, *Missouri River Basin.

Water Resources data for the 1980 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Volume 1 of this report contains discharge records for 161 gaging stations; stage only records for 1 lake; stage and contents for 11 lakes and reservoirs; water quality for 93 gaging stations, 44 ungaged stations, 100 wells and springs; and water levels for 36 observation wells. Also included are 74 crest-stage partial-record stations and 2 precipitation monitoring sites. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. This data represents that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (USGS)
W82-02846

WATER RESOURCES DATA FOR MISSISSIPPI, WATER YEAR 1980.
Geological Survey, Jackson, MS. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-149006, Price codes: A18 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report MS-80-1, 1981. 414 p, 5 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Mississippi.

Water resources data for the 1980 water year for Mississippi consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report contains records of water discharge at 82 gaging stations, stage records for 17 of these gaging stations, stage only at 4 gaging stations, contents for 4 lakes, water quality for 32 gaging stations and 105 wells, and water levels for 360 observation wells. Also included are peak-discharge data for 94 crest-stage partial-record stations and water quality data at 19 partial record or miscellaneous sites. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Mississippi. (USGS)
W82-02847

8. ENGINEERING WORKS

8A. Structures

FUNDAMENTAL CONCEPTS OF WELL DESIGN,
Ground Water Associates, Inc., Westerville, OH.
E. B. Williams.
Ground Water, Vol 19, No 5, p 527-542, September/October, 1981. 7 Fig, 1 Tab, 28 Ref.

Descriptors: *Well hydraulics, *Design criteria, *Well design, Groundwater movement, Well screens, Screened wells, Geohydrology, Hydraulic conductivity, Reynolds Number, Turbulent flow, Aquifer characteristics, Filters.

Proper well design should rely on more than a knowledge of aquifer properties and screen entrance velocity. The most important factor is proper sizing of the artificial gravel filter materials and screen slot openings. The critical approach velocity, valuable in determining the borehole diameter, may be obtained from the relationship between the hydraulic conductivity and the gradient in the aquifer and from aquifer grain size. The tendency for turbulent flow, described by the Reynolds Number, is used to determine screen diameter. Screen entrance velocity is useful in evaluating open area in regard to screen construction. Graphs and tables are presented to help in the design process. (Cassar-FRC)
W82-02614

RATIONAL DIMENSIONS OF AN EARTH BLANKET AND ITS SEEPAGE CALCULATION,
N. S. Chyong.
Hydrotechnical Construction, No 3, p 256-262, March, 1980. 4 Fig, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 28-31, March, 1980.

Descriptors: *Earthworks, *Hydraulic structures, *Estimating equations, *Seepage, Mathematical studies, Permeability, Earth dams, Dam construction.

A method for determining the optimal thickness and length of a rational earth blanket for hydraulic

structures is presented. This method considers preservation of a prescribed seepage discharge and a permissible value of the gradient of seepage head in the foundation of the structure. The use of a blanket of constant or almost constant thickness is irrational because in one region the cutoff capacity of the blanket may be excessive and in another the gradient of the head may be greater than the permissible limit. Thus piping can occur. Equations are presented for determining the thickness of the blanket over its entire length. (Small-FRC)
W82-02666

IMPROVEMENT OF THE SEALS OF EXPANSION JOINTS OF HYDRAULIC STRUCTURES,
N. F. Shchavelev.
Hydrotechnical Construction, No 3, p 230-236, March, 1980. 4 Fig, 2 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 12-16, March, 1980.

Descriptors: *Construction joints, *Hydraulic structures, *Performance evaluation, *Sealants, Leakage, Dam construction.

The degree of reliability of existing seals of expansion joints was established by analyzing data on seal performance at 220 operating Soviet and other hydraulic structures. This investigation led to the development of several fundamentally different new seal designs. In expansion and filled expansion-settlement joints, the penetration of the asphalt material from the cavity of the water stop into the joint is a slow process. If the joint is filled flowing from the water stop, water-tightness is increased. There are frequently problems with the installation of contour seals at locations where the joints intersect various service rooms in an underground part. If the existing main seal in the joint protects these rooms from water entry, additional seals are not necessary. These suggestions can increase the efficiency of seals used in the expansion joints of large concrete and reinforced concrete hydraulic structures. (Small-FRC)
W82-02669

USE OF CRACK-RESISTANT LININGS OF HYDRAULIC TUNNELS WITH CONSOLIDATION GROUTING OF THE ROCK,
E. I. Zhokhov, and A. K. Fedulov.
Hydrotechnical Construction, No 3, p 225-229, March, 1980. 1 Fig, 1 Tab, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 9-12, March, 1980.

Descriptors: *Tunnel linings, *Tunnel construction, *Grouting, Tunneling, Tunnels, Seepage control.

High-pressure grouting can be used to create crack-resistant linings in hydraulic pressure tunnels. This method uses less materials than other lining techniques, decreases seepage leaks from the tunnel, and prevents hydrostation production losses. It is best to use the method in circular tunnels of not more than 5-6 m diameter. Many holes can be simultaneously grouted as the grout flows along the return pipeline. Laboratory and on-site investigations are necessary to select the optimum grout formula and to evaluate the effectiveness of grouting under the specific geological conditions of the tunnel. A disadvantage of the method is the large amount of labor required. (Small-FRC)
W82-02670

BITUMINOUS CONCRETE ANTISEEPAGE CURTAIN FOR CONCRETE DAMS,
N. F. Shchavelev.
Hydrotechnical Construction, No 6, p 561-566, June, 1980. 4 Fig, 2 Tab, 7 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 6, p 12-15, June, 1980.

Descriptors: *Asphaltic concrete, *Seepage control, *Dam design, Concrete dams, *Materials engineering, Hydraulic structures, Waterproofing, Insulation, Fiberglass, Pressure distribution, Deformation, *USSR.

A poured porous clay-asphalt concrete is suggested as a waterproofing curtain to protect the upstream face of a dam. The material is a mixture of asphalt (17.4%) with 5-10 mm porous clayey gravel (25%), 0-5 mm porous clay sand (20.5%), rubber crumb (0.6%), and a powdered mineral filler (36.5%) composed of limestone, dolomite, and waste cement. The mixture is self-sealing, easy to handle during construction, and also serves as thermal insulation. The deformation and pressure propagation in the asphaltic material was investigated. For a curtain with a 10 cm thick reinforced concrete wall and anchors 28 mm in diameter, 60 x 60 cm on centers, the internal presure in the insulating layer is adequate when the structure is first placed in service and increases by 0.025 MPa at 5 years and by 0.220 MPa at 100 years after filling. With a thinner reinforced concrete wall, smaller anchors, or fiberglass insulation, internal pressure increases are smaller or imperceptible. (Cassar-FRC)
W82-02690

PROSPECTS OF USING RADIAL GATES ON OVERFLOW DAMS OF LARGE HYDROELECTRIC STATIONS,
D. M. Savin.
Hydrotechnical Construction, No 3, p 241-244, March, 1980. 2 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 19-21, March, 1980.

Descriptors: *Hydraulic gates, *Hydroelectric plants, *Dam design, Gates, *Radial gates, Piers, Overflow, Design criteria, Hydraulic structures, Mechanical equipment, Spillways.

Radial gates have several advantages over vertical lift gates in overflow dams: smaller forces required for maneuvering, more reliable seating on the sill, absence of grooves which may fill with ice, and better conditions for passage of ice. However, the large concentrated loads transmitted from the main pivots to the concrete limit the load on each hinge of 5000 kN unless other design modifications are made (larger piers, longer spillways). In several dams throughout the world transmission of larger loads, on the order of 15,000-20,000 kN from each gate hinge, has been accomplished with prestressed cables. A load of 50,000 kN per hinge can be handled by a double-cantilever radial gate supported on intermediate piers without using any prestressed cables, according to a design for the Bureya hydroelectric station. (Cassar-FRC)
W82-02693

IMPULSE TECHNOLOGY FOR SURFACE COMPACTION OF CONCRETE MIXES IN CONSTRUCTION OF SLOPE REVETMENTS,
For primary bibliographic entry see Field 8B.
W82-02695

ESTIMATION AND OPTIMIZATION OF THE SERVICEABILITY OF UNDERGROUND WATER TRANSMISSION NETWORK SYSTEMS UNDER SEISMIC RISK,
Columbia Univ., New York.
R. Y. Tan.
PhD Dissertaion, 1980. 81 p, 22 Fig, 7 Tab, 21 Ref. University Microfilms International, Ann Arbor, MI; Order No GAX81-13563.

Descriptors: *Water distribution, *Water conveyance, *Water mains, Network design, Seismic waves, Earthquakes, California, Underground water transmission system.

The purpose of this research is (a) to develop a methodology for the assessment of the risk underground water transmission systems in seismically active areas are subjected to in terms of the degree of possible unserviceability resulting from destructive earthquakes and also (b) to develop procedures for the optimum design of systems to be newly constructed as well as for the optimum improvement of existing systems on the basis of cost-effectiveness considerations. For the analysis, a water transmission system adapted from the actual Los Angeles City system was used, taking into account the existence of the major faults surrounding and penetrating the system, the topological and structural characteristics of the water transmission network, conditions of the soil and ground in which the system is imbedded, and the probabilistic nature of the location, frequency and magnitude of future earthquakes. A Monte Carlo technique was used to simulate a sample of damaged states of the transmission network. The Newton-Raphson method was then utilized to analyze each of the damaged states of the network for its flow characteristics. The result of this analysis determines whether or not the network remains serviceable under each simulated state of damage and hence leads to a Monte Carlo estimation of the probability of system serviceability. Procedures for optimizing the total cost are developed in which the pipe diameters and the network topology are parameters which can be varied to achieve a maximum total cost under certain realistic constraints. (Sinha-OEIS)
W82-02743

CONSTRUCTION OF A BASIC-GATE UNIT FOR THE DEEP CATASTROPHIC SLUICE AT THE NUREK HYDROELECTRIC PLANT,
F. I. Gurtovnik, S. V. Shutenkov, and A. K. Mel'nikov.
Hydrotechnical Construction, No 6, p 556-560, June, 1980. 4 Fig, 6 Ref. Translated from Gidroteknicheskoe Stroitel'stvo, No 6, p 9-12, June, 1980.

Descriptors: *Sluice gates, *Hydroelectric plants, Power plants, Sluices, *Flood control, Channels, Conduits, Electric power, Hydraulic engineering, Reinforced concrete, *Reservoir releases, Construction, Design criteria, Nurek hydroelectric plant, *Russia.

The deep catastrophic sluice at the Nurek hydroelectric plant is a 1337 meter long trough-shaped tunnel with a section varying from 90 to 115 square meters and an inlet portal 100 meters below the reservoir's normal support level. The sluice is designed to discharge flood flows of up to 2000 cubic meters per second, with a full reservoir during the period when the hydraulic facility is in operation. The sluice will also discharge construction flows during the concluding stages of construction on the basic structures. Due to special conditions prevailing at the time of construction, a temporary scheme for maneuvering the basic sluice gates was devised. The temporary scheme was needed primarily to ensure operation to some degree when the flood season was imminent. Construction was completed in time for the floods due to a reduction in the volume of construction-assembly work and a shortening of construction times. The construction of supports for the underground working-gate unit in sectional reinforced concrete made it possible to reduce the time needed for construction of the unit due to the concurrent construction-assembly operations. The adoption of reinforced-concrete support designs in combination with anchors enabled the builders to deviate from the traditional method employed to build similar units using reinforced concrete arches. (Baker-FRC)
W82-02771

ON-SITE INVESTIGATIONS OF THE CONTACT ZONE OF THE UPSTREAM FACE OF THE CONCRETE DAM ON THE UST-ILIM HYDROELECTRIC STATION,
V. N. Durcheva, and S. M. Puchkova.
Hydrotechnical Construction, No 6, p 595-600, June, 1980. 3 Fig, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 6, p 32-35, June, 1980.

Descriptors: *Dams, *Hydroelectric plants, *Concrete, Powerplants, Construction, Spillways, Strain measurement, Reservoir filling, *Temperature effects, Dam design, Ust-Ilim Dam, *Russia.

The Ust-Ilim concrete dam has a maximum height of 105 meters, slope of the downstream face 1:0.7, and was constructed on a strong diabase foundation. The channel part of the upstream face of the dam is formed by 36 sections: 18 powerhouse, 11 spillway, and 7 nonoverflow. Vertical strain

gauges were installed at a distance of 0.5 meters from the upstream face in the axial cross section along the base of each half-section. The conditions present at the contact zone under the upstream face depend on the design features of the sections and temperature regime during filling of the reservoir. The maximum propagation of the contact crack to 13 meters occurred in the powerhouse sections before linking to the powerhouse with open conduits that communicated with the outside air. For theoretical studies of the boundaries of decompression of the foundation of the contact zone under the upstream face of a gravity dam it is necessary to consider stresses during the construction period, the effect of the shape of the offset profile, and the temperature regime of various types of sections. Vertical cracks in the concrete of the contact slab of temporary dewatering outlets can become paths of concentrated seepage. The design features of spillway sections caused a state of three-dimensional stress of the contact zone, with transmission of the loads of the construction period and during filling of the reservoir. In the majority of drain wells, the water level is at the level of the rock-concrete contact joint. Flowing wells and flow of water through transverse drainage galleries are observed only in several powerhouse sections. Wells are also flowing in several spillway sections. Seepage flow through the rock foundation is not being monitored. (Baker-FRC)
W82-02773

STUDY OF THE EXPERIENCE IN OPERATING HYDRAULIC TUNNELS,
V. M. Mostkov, and V. S. Serkov.
Hydrotechnical Construction, No 1, p 44-49, January, 1980. 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 1, p 26-28, January, 1980.

Descriptors: *Tunnel linings, *Hydroelectric plants, *Inspection, Hydraulic structures, Tunnel failure, Design criteria, Concrete construction, Linings, Cracks, Damage, Diversion structures, Grouting, Corrosion, *USSR.

Most of the 300 km of pressure and free flow hydraulic tunnels operating in the Soviet Union have been in satisfactory condition, according to inspections begun in 1972. Several cases of deterioration are reported. Typical is the Tereblya-Rika pressure diversion tunnel, which showed waterlogging and slope deformation along the tunnel route. These conditions were caused by cracks in the concrete lining and a circular crack at the connection with the metal lining of the penstock. Repairs included injection of cement grout, sealing of the circular crack, and reinforcement of the cracked lining with a 70 m metal sleeve. There are three main causes of damage to tunnels: incorrect evaluation of rock mass properties during design, deviations from specifications during construction, and corrosion during operation. Since the physical properties of rock masses are very difficult to predict, it is suggested that characteristics of the same rock mass be measured before and after operation of the tunnel. The differences can be used in design of analogous tunnels. Common construction deviations from specification include insufficient cleaning of the rock surface before concreting the lining, errors and low-quality ingredients in mixing concrete, untimely placement of concrete, inadequate compacting of the concrete mix, inadequate grouting, and unclean reinforcement material. A systematic analysis of tunnel operating experiences is needed. (Cassar-FRC)
W82-02782

CALCULATION OF DIVERSION TUNNELS OF SPECIAL PROFILES OPERATING UNDER CONDITIONS OF A FREE UNIFORM FLOW,
V. N. Kozin.
Hydrotechnical Construction, No 4, p 392-394, April, 1980. 1 Fig, 2 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 4, p 40-41, April, 1980.

Descriptors: *Tunnel hydraulics, *Diversion structures, Graphical methods, Mathematical equations, Discharge capacity, Uniform flow, Turbulent flow, Design criteria, Diversion structures, *USSR.

The dimensions and the velocity and depth of a uniform flow in a horseshoe diversion tunnel are calculated from the height, discharge, degree of filling, and roughness coefficient. This is a more difficult computation than the inverse solution, determining discharge capacity from tunnel dimensions. The determination is based on a classification of diversion tunnels into 5 profiles by the USSR agency concerned with hydroelectric station construction. A graph represents characteristics of the cross-section and hydraulic radius for different degrees of filling. These values are used in equations to calculate the desired parameters. This procedure may be used to develop graphs for other tunnel profiles. (Cassar-FRC)
W82-02785

STRESS RELAXATION IN CONCRETE OF MASSIVE HYDRAULIC STRUCTURES,
E. A. Kogan.
Hydrotechnical Construction, No 9, p 916-920, September, 1980. 4 Fig, 2 Tab, 12 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 9, p 24-27, September, 1980.

Descriptors: *Concrete technology, *Stress relaxation coefficient, Hydraulic structures, Materials enginering, Dam design, Hydroelectric plants, *Dam construction, *USSR.

Experimental values of the stress relaxation coefficient (Kr) were obtained by testing large-scale concrete specimens, 50-70 cm wide and 200-220 cm high. These were prepared with concrete mixes (grades 200, 300 and 450) from dams under construction in the USSR. Families of curves are presented for Kr at different ages of concrete, up to 200 days. A table gives coefficients for 300 grade concrete of ages 1 to 900 days at concrete ages of 1 to 720 days at the time of stress increase. Concrete age substantially affects the degree of stress relaxation, differing by a factor of 2-3 between 3 and 500 days, and must be considered up to at least 180 days. At an age of 3 days, limiting values of Kr for concrete of all three grades are close to 0.25. Mature concrete is characterized by Kr limiting values of 0.54 for grade 200 and 0.64-0.67 for grades 300 and 450. (Cassar-FRC)
W82-02786

ARGENTINA'S HYDROELECTRIC-BASED ENERGY PLAN,
B. Bronstein.
Power Engineering, Vol 85, No 1, p 50-51, January, 1981. 1 Fig, 1 Tab.

Descriptors: *Electrical networks, *Hydroelectric power, *Water resources development, Dams, Electric power production, Nuclear energy, Electric powerplants, Thermal power plants, Hydroelectric plants, Thermal power, *Argentina.

Argentina's new energy program, designed to reduce dependence on petroleum, will rely on 21 planned hydroelectric powerplants. The new plants are expected to be built at a cost of $22 billion by the year 2000. Six nuclear powerplants will be constructed as a backup system, and the country's present transmission system will expand to 10,900 miles by 1995. Argentina's rivers have a potential electric power source of about 140,000 GWh. Hydroelectric power will account for 25,000 additional MW by the year 2000; the current production is 9300 MW. In 1995 conventional thermal plants will supply 61% of the electricity needs while nuclear power will provide 10%. The $5.7-billion Yacyreta project and the Corpus project are joint Argentine-Paraguayan ventures. The Parana Medio complex, downstream from the Yacyreta, will contain two hydroplants with a combined installed capacity of 5600 MW. Other projects are being planned at the Pati section, Chapeton. The five hydro projects are slated for the Limay River. Eight smaller hydroelectric projects having a total installed capacity of 2200 MW will supply electricity to the western provinces of Mendoza and San Juan. Most of the projects will be financed from supplier creditors and maintained by semi-private utilities. The government hopes to generate international interest in expanding its water resources through international public tenders for these projects. (Geiger-FRC)
W82-02794

STAGES OF PROGRESS IN THE ORGANIZATION OF HYDRAULIC CONSTRUCTION,
Main Administration for Construction and Installation of Hydroelectric Power Plants in the East (USSR).
V. L. Kuperman.
Hydrotechnical Construction, No 10, p 1027-1035, October, 1980. 3 Fig, 31 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 10, p 23-27, October, 1980.

Descriptors: *Construction, *Hydraulic engineerings, *USSR, Dam construction, Reservoir construction, Construction materials, Hydraulic design, Hydraulic structures, Permafrost, Frozen ground, Earth dams.

In the initial period of water-power construction in the USSR, water power was based on fundamental studies of prominent Russian scientists of the prerevolutionary period and on foreign experience and techniques in practical matters. Later development differed markedly from experiences gained elsewhere. Considering the complexity of the construction problems, the subdivision on water power construction was created in the system of the Main Administration for the Electrification of Russia. Initially hydroelectric plants were built on small mountain rivers in Central Asia, Caucasia, the Kola Peninsula, and in other regions on the basis of the derivation scheme. Later, highly economical derivation hydroelectric plants and networks were built on mountain rivers. The experience gained with the construction of the first relatively low-head hydroelectric plants in Siberia, the Ust-Kamenogorsk, Novosibirsk, and Irkutsk plants, has made it possible to proceed with the construction of hydroelectric plants with dams built of local materials in permafrost regions. Especially in regions with permafrost, dams built of local earthen materials with the underground disposition of power structures have been found most economical. The world's largest arch dams were designed for the Inguri and Chirkey hydroelectric plants. The presence of complex geologic conditions and local building materials made it possible to derive the optimum solution using dams constructed of earthen materials. The 300 meter high dam for the Nurek hydroelectric plant is being constructed of a gravelly conglomerate material with an antiseepage core formed from a sandy-loam material. (Baker-FRC)
W82-02858

UMFOLOZI ROAD BRIDGE HYDRAULIC MODEL INVESTIGATION,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
J. A. Zwamborn.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1317-1333, November, 1981. 15 Fig, 11 Ref.

Descriptors: *Model studies, *Bridges, Hydraulic models, Rivers, Sediments, Scour, Abrasion, Erosion, *Bridge design, *Umfolozi River, Zululand, *South Africa.

A movable-bed hydraulic model study is described which was made to determine the optimum position, length, and pier alignment of a new road bridge across the Umfolozi River in Zululand, South Africa. The model scaling techniques were proved efficiently correct by reproducing, in the model, recorded scour depths and general river bed changes caused by a major flood. The study showed that the originally proposed bridge site had serious disadvantages, and a much better site was established. The required bridge length was reduced from 1,200 ft to 700 ft. In addition to the savings in bridge length, the study resulted in a considerable saving on the foundation depth, due to the reliable scour depth predictions obtained from the movable-bed model. The model was designed in accordance with the shear/settling velocity criterion, and crushed anthracite was used as

bed material. The horizontal and vertical scales were 1 in 250 and 1 in 100 respectively. The velocity scale was based on Froude's law and, with the large tractive force in this steep river, it was necessary to deviate from the criterion. (Baker-FRC)
W82-02868

ENGINEERING RESPONDS TO ECOLOGY,
Whitman and Howard, Inc., Wellesley, MA.
For primary bibliographic entry see Field 5D.
W82-02935

EXPERIENCE WITH AND THE EFFECTIVENESS OF AUTOMATIC SYSTEMS FOR CONTROL OF LOADING-HAULING OPERATIONS DURING CONSTRUCTION OF THE DAM FOR NUREK HYDROELECTRIC PLANT,
S. Ya. Lashchenov, V. I. Rymarevich, V. V. Vil'vovskii, and M. Yu. Gornshtein.
Hydrotechnical Construction, No 11, p 1109-1114, November, 1980. 2 Tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 11, p 6-9, November, 1980.

Descriptors: *Hydroelectric plants, *Dam construction, *Control systems, Construction, Rock fill, Earth dams, Automation, Computers, Data processing, Hydraulic engineering, Quarries, *Nurek hydroelectric plant, *USSR.

The Karat automatic system for control of loading-hauling operations was used effectively in the construction of the high earth dam for the Nurek hydroelectric plant (300 m high and 52 million cu m in volume). The system is designed for 256 dump trucks, 3 weighing stations, and 19 loading-unloading stations. It secures trucks for the loading-unloading stations, automatically weighs vehicles in transit, conveys loading-unloading locations to drivers, totals volumes loaded and discharged, and records statistics connected with each truck. All data is stored on perforated tape, which is processed in a computer to provide further information on performance, wages, materials handled, etc. The control method improved efficiency by 88-98%. (Cassar-FRC)
W82-02948

CONSTRUCTION OF THE DIVERSION PRESSURE TUNNEL OF THE INGURI HYDROELECTRIC STATION,
L. S. Gabuniya, and G. Ya. Zarandiya.
Hydrotechnical Construction, No 2, p 122-130, February, 1980. 4 Fig, 1 Tab. Translated from Gidroteknicheskoe Stroitel'stvo, No 2, p 9-13, February, 1980.

Descriptors: *Tunnel construction, *Hydroelectric plants, Tunnel linings, Tunneling, Concrete construction, Linings, Karst hydrology, *Inguri River, Diversion structures, Construction, Engineering, Civil engineering, *USSR.

The Inguri hydroelectric station tunnel is unique among Soviet hydraulic tunnels with respect to size and head. The diversion pressure tunnel, 15.05 km long and 9.5 m in diameter, has a head at the start of 105 m and at the end, 165 m. Design discharge is 450 cu m per sec and slope 0.0038. Two arch bridges convey metal conduits across two gorges. Construction began in 1963 and was completed in 1978. The work was slowed during the first years by 43 karst formations, inflow of subsurface waters at up to 800 liters per sec, and heavy precipitation. As work proceeded, methods and equipment were modified to improve efficiency. In strong, slightly fractured rocks, the lining was lightly reinforced concrete 0.5 m thick, with grouting of rocks to 6-10 m at a pressure of 4 MPa. Severely fractured rocks were lined with load bearing reinforced concrete 0.5-0.8 m thick with grouting of rocks to 6 m under 3.5-4MPa pressure. In crushed rocks a combined lining was used, with an outside concrete ring 0.8-1 m thick and inside steel shell 25-40 mm thick. Rock grouting was done to 3 m under 3.5 MPa. Drilling, blasting, installation of linings, and grouting are described in detail. Techniques especially useful for this project were use of a drilling frame, increased depth of shot holes, mechanized travelling concrete form units, drilling-grouting frames, and assembling the metal facing without a turnover device. (Cassar-FRC)
W82-02949

PROGRESSIVE SOLUTIONS IN THE DESIGN OF UNDER-GROUND STRUCTURES FOR THE ROGUN HYDROELECTRIC PLANT,
L. G. Osadchii, V. F. Ilyushin, and I. S. Bubman.
Hydrotechnical Construction, No 6, p 546-555, June, 1980. 5 Fig, 3 Tab, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 6, p 3-9, June, 1980.

Descriptors: *Hydroelectric plants, *Underground structures, Excavation, Design criteria, Construction, Mechanical equipment, *Tunnel construction, Sluices, Conduits, Tunnel linings, Intakes, Seepage control, Explosives.

Plans for construction of the Rogun hydroelectric plant underground complex were modified to produce a proposed savings of 30% in construction rate. The 60 km of underground structures included a powerhouse, construction tunnels, sluices, structures to protect the salt stratum, structures to protect agricultural land, and service tunnels. Some of the innovative solutions were spiral motor transport tunnels, auxiliary galleries built in connection with large span excavations, a truck fleet composed of both light and heavy duty vehicles, preliminary strengthening of disturbed rock sections, protection of the salt stratum by freezing, contour blasting, two-stage opening of vertical excavations, mechanization of mining and tunneling, and central concrete mixing plant. (Cassar-FRC)
W82-02950

CLOSURE OF THE KAMA RIVER AT THE SITE OF THE LOWER KAMA HYDROELECTRIC PLANT,
V. I. Astafichev, M. L. Neminskii, S. V. Novatorov, and K. V. Korchits.
Hydrotechnical Construction, No 4, p 351-358, April, 1980. 4 Fig, 1 Tab. Translated from Gidroteknicheskoe Stroitel'stvo, No 4, p 15-20, April, 1980.

Descriptors: *Dam construction, *Channel scour, *Hydroelectric plants, Rivers, *Kama River, *USSR, Channels, Engineering, Civil engineering.

The Kama River (500 m wide, 7-11 m deep, and 5 m sandy bottom) was closed in three stages. In the first stage the channel was stabilized with a rock lining 1 m thick, 22,800 sq m in area, and 17,700 cu m in volume. This material was dropped from dump trucks through 512 holes in the ice during the winters of 1977 and 1978. The second stage involved narrowing the channel with a pervious core composed of sand, rock and concrete blocks, with concurrent hydraulicking of the channel dam. Unusually high flows in June and October caused considerable channel scour and slides in the pervious core material. During this period average velocities were 3.4 m per sec: maximum velocity, 4 m per sec at the core. River flows attained 9170 cu meters per sec during the June flood. The trench for the hydroelectric plant was flooded October 25, 1978. Final channel closure began Oct. 17, at which time the opening was 218 meters in the downstream cofferdam, and the river flow was 5360 cu m per sec. On Oct 30 navigation was suspended and the third stage began. The closure, lasting 56 hours, proceeded from both banks at an average of 2.5 m per sec. Crest width averaged 12 m. During this period the river flow was 5000 cu m per sec, twice the design flow. To reduce flow to a reasonable limit, an upstream reservoir output was reduced. As the work progressed, it was obvious that the pervious core method was indeed the most suitable for closure in this situation. The frontal method and closure without a pervious core would have been inexpedient. (Cassar-FRC)
W82-02951

EXPERIENCE IN THE CONSTRUCTION AND FIRST YEARS OF OPERATION OF THE ZEYA DAM,
A. P. Epifanov, V. N. Vagner, V. V. Kon'ko, V. I. Sil'nitskii, and A. M. Chaika.
Hydrotechnical Construction, No 8, p 759-764, August, 1980. 3 Fig, 1 Tab, 4 Ref. Translated from Gidroteknicheskoe Stroitel'stvo, No 8, p 2-5, August, 1980.

Descriptors: *Hydroelectric plants, *Dam construction, *Grouting, Construction, Buttress dams, Hydraulic structures, Concrete construction, Freezing, Temperature.

The Zeya Dam was constructed in 1970-1978 at temperatures from -2.5 to +0.4 C. Mean annual air temperature was -4.1 C, mean January temperature -30.1 C. The butress dam contains hollow sections, which limit penetration of negative temperatures into the concrete. Grouting was facilitated because the concrete quickly cooled to the desired temperatures. Reinforced concrete insulated forms prevented large differences in temperature between the core and exterior face. When the spillway was constructed in 1978, the formwork was left in place for 12-18 hours and then removed so that overdrying and cracking of the surface were minimized. Proper grouting temperatures were achieved by cooling in summer and heating in winter. A method of grouting was worked out so that a stress was maintained on the dam, forcing the support head toward the upper pool. It was found that minimum winterization, to a height of 12-15 m of the contact zone, produced a favorable stress which improved contact between the columns during cooling of the concrete. Maximum water levels were 55.2 m in 1975, 61.2 m in 1976, 69.9 m in 1977, and 76.9 m in 1978. The freeboard is 102 m. (Cassar-FRC)
W82-02952

8B. Hydraulics

SELECTING PIPELINES TO ACHIEVE EFFECTIVE ENERGY CONSERVATION,
Freese and Nichols, Fort Worth, TX.
T. A. Reid.
Water and Sewage Works, Vol 127, No 11, p 53, 54, 64, 65, 74, November, 1980. 3 Fig, 2 Tab.

Descriptors: *Cost analysis, *Pipelines, *Energy loss, *Flow friction, Hydraulics, Pipes, Pipe flow, Mathematical studies, Flow, Flow characteristics, Pressure distribution, Water distribution, Friction loss.

A mathematical expression for calculating the 'demand characteristics' of pipelines is presented to examine their energy requirements over their total lifetime. The demand characteristic concept was used to calculate a more realistic estimate of annual energy requirements for the Fort Worth Holly pressure plane and the South Side IIIs pressure plane. By assuming comparable maintenance and labor costs for the pipelines of these two pressure planes and calculating (from unit energy costs and estimated construction costs) an optimum operating flow rate for each particular pipe, the optimum average flow rates for a range of pipe diameters were compared. When the demand characteristic was increased, the magnitude of the optimum flow ranges was decreased. The cost per unit of flow at the optimum flow rate decreased as pipe diameter increased. Frictional head losses were also calculated for each annual optimum flow range. The velocity and frictional head losses associated with maximum flows for the Holly and South Side pressure planes tended to be higher than those designated as acceptable from past experience. Larger pipe diameters were recommended for more satisfactory system operation in both of the Fort Worth study areas. (Geiger-FRC)
W82-02609

THE EFFECT OF WIND ON ICE PRESSURE ON RIVER STRUCTURES,
For primary bibliographic entry see Field 2C.
W82-02668

BOUNDARY CALCULATIONS OF SLUICE AND SPILLWAY FLOWS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
A. H. D. Cheng, J. Liggett, and P. L. F. Liu.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY10, p 1163-1178, October, 1981. 10 Fig, 3 Tab, 21 Ref.

Descriptors: *Estimating equations, *Boundaries, *Spillways, *Sluices, Flows, Mathematical studies, Hydraulic structures.

The Boundary Integral equation Method (BIEM) was applied in a scheme based on a perturbation principle to provide rapid convergence of the solution to problems of sluice gates and spillways. This technique is a step towards the replacement of physical models with numerical calculations. The procedure for the solution of the sluice gate problem is outlined, and the accuracy and efficiency of the BIEM solution is compared with a recent FEM solution. The efficiency of the BIEM solution in terms of the number of iterations, number of elements, and computation time is clearly superior to the FEM for comparable accuracy. The spillway solution procedure is also outlined. The BIEM results for a standard WES spillway conform closely to the experimental curve. (Small-FRC)
W82-02677

PROSPECTS OF USING RADIAL GATES ON OVERFLOW DAMS OF LARGE HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 8A.
W82-02693

EFFECT OF WAVE SLOPE ON A ROCK MASS IN A REVETMENT,
M. E. Plakida.
Hydrotechnical construction, No 9, p 931-936, September, 1980. 1 Fig, 1 Tab, 13 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 9, p 33-36, September, 1980.

Descriptors: *Wave action, *Retaining walls, *Shore protection, Revetments, Riprap, Breakwaters, Mathematical equations, Hydraulic structures, Rock fill, Slope stabilization.

Fifteen existing formulas for calculating the mass of rock in a riprap revetment of a slope under the effect of waves were analyzed. It was concluded that the rock mass in question is directly proportional to the square root of the wavelength, other conditions being equal. Corrections to the standard equations were suggested for use with wave slopes between 10 and 25, the most commonly encountered values. The corrected equation produced 22-33% smaller estimates of the required rock masses than did the standard equations, especially in the case of short, steep waves. (Cassar-FRC)
W82-02694

IMPULSE TECHNOLOGY FOR SURFACE COMPACTION OF CONCRETE MIXES IN CONSTRUCTION OF SLOPE REVETMENTS,
A. A. Afanas'ev, A. I. Boikov, Yu. G. Trukhin, and V. I. Il'in.
Hydrotechnical Construction, No 11, p 1126-1129, November, 1980. 3 Fig, 2 Tab, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 11, p 16-18, November, 1980.

Descriptors: *Concrete technology, *Compaction, *Slope stabilization, Construction, Revetments, Impulse compaction, Retaining walls, Hydraulic structures, Mechanical equipment, Dams, Dikes.

A method for compaction of stiff concrete mixes using an impulse vibration system has saved time and improved concrete strength in construction of slope revetments. Essentially the procedure consists of transmitting energy impulses to the concrete mix from the top through a live element in the form of plates connected by elastic links. The low-frequency impulses propagated through the mix carry a large energy reserve and cause the mix to be in a state of flow and compaction. Tests showed that maximum compaction effects were reached in the frequency range 15-20 Hz for pulsation amplitudes of 3-5 mm. compaction depth for mixes with a stiffness index of 30 sec was 40-50, and for 60-90 sec stiffness, 30 cm. Examination of samples taken from an experimental concrete strip, weathered for 2 years, showed a porosity of less than 1.4% and an increase in strength of 40%. A 46.8 ton machine was developed for mechanized placement and compaction of concrete mixes on slopes of up to 1:4. This apparatus reduced labor by a factor of 8-10 and reached the required quantity of cement by 5-8%. (Cassar-FRC)
W82-02695

APPLICATION OF RELIABILITY THEORY TO HYDRAULIC ENGINEERING DESIGN,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
L. Duckstein, and I. Bogardi.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY7, p 799-815, July, 1981. 3 Fig, 2 Tab, 36 Ref.

Descriptors: *Hydraulics, *Floods, *Probabilistic process, *Statistical analysis, Hydraulic engineering, *Systems analysis, Rivers, Levees, Earthworks, Soil properties, Gaging stations, Peak flow, Soil mechanics, Time series analysis, Carrying capacity, Velocity, Regression models.

The safety of complex hydraulic structures, such as river dams, is analyzed using a probabilistic approach. The approach combines the work of Freudenthal with the work of Cornell and Lind. The proposed approach takes into consideration the stochastic character of flood load, the various degrees of protection along the levee, and the different modes of failure. The probability of failure in a given cross section is calculated, as well as the probability of failure of a levee reach. Both load and resistance are considered as random variables. The probability of failure is then a function of two random variables. High values calculated for the probability of levee failure are in agreement with observed values. (Titus-FRC)
W82-02699

MODELING CAVITATION FOR CLOSED CONDUIT FLOW,
Utah State Univ., Logan. Water Research Lab.
J. P. Tullis.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, HY11, p 1335-1349, 1981. 3 Fig, 3 Tab, 17 Ref.

Descriptors: *Model studies, *Cavitation, Flow, Fluid mechanics, *Closed-conduit flow, Closed systems, Hydraulics, Pipes, Scaling.

A procedure is demonstrated for modeling cavitation for closed conduit flow. A portion of a model study is presented which described the procedure for determining four cavitation limits and how to evaluate and adjust for scale effects. The item tested was a long radius elbow, but the procedure applies to any pipe component or valve used in closed conduit flow. Cavitation limits evaluated are incipient, critical, incipient damage, and choking cavitation. Scale effects associated with change in size and velocity of pressure are evaluated and used to adjust the model data to the prototype conditions. No scale effects related to changes in velocity or pressure are found for any of the four cavitation limits. Incipient and critical cavitation are found to change significantly with size of elbow. For most systems the practical design limit lies between the critical and incipient damage. As one operates beyond the value of the cavitation index, the noise and vibrations increase rapidly. This study determined that the velocities through the prototype system were sufficient to cause the elbows to operate in choking cavitation. (Baker-FRC)
W82-02700

BOUNDARY SHEAR IN SMOOTH AND ROUGH CHANNELS,
Birmingham Univ. (England). Dept. of Civil Engineering.
D. W. Knight.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY7, p 839-851, July, 1981. 11 Fig, 1 Tab, 9 Ref.

Descriptors: *Shear stress, *Channel flow, *Flumes, Flow, Boundary processes, Open-channel flow, Roughness coefficient, Hydraulics.

Equations for calculating the mean wall or bed shear stress for flows in a rectangular channel over a wide range of differential roughness and breadth to depth ratios are given. The data, derived from two previous papers, is now in a more useful form for persons involved in flume studies. It is expected that the equations, especially for smooth channel conditions, will be improved as further data becomes available. (Cassar-FRC)
W82-02711

MEASUREMENTS OF SELF-AERATED FLOW ON A SPILLWAY,
Pearson Bridge Ltd, St. Leonards. (Australia).
P. Cain, and I. R. Wood.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY11, p 1425-1444, November, 1981. 16 Fig, 3 Tab, 10 Ref.

Descriptors: *Spillways, *Aeration, Dams, Bubbles, Aviemore Dam, Cavitation, Hydraulics, Channels.

Measurements were made on the spillway of a 36 meter high concrete gravity dam. Measurements taken included the point of inception, the velocity distribution and air concentration distribution, as well as bubble size in the developing region of the flow. There appeared to be a universal velocity distribution which was independent of the mean air concentration for average air concentrations of between 0 and 0.5; the air concentration becomes progressively more uniform with distance downstream. At 100 times the depth at the point of inception a significant air concentration has reached the spillway floor. It is noted that, provided the point of inception of air entrainment occurs sufficiently far downstream of the crest, a minor modification of Bauer's work gives direct design formulas. (Baker-FRC)
W82-02715

DISCHARGE CHARACTERISTICS OF TRIANGULAR-NOTCH THIN-PLATE WEIRS,
Geological Survey, Reston, VA. Water Resources Div.
J. Shen.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price: $3.75. Geological Survey Water-Supply Paper 1617-B, 1981. 45 p, 43 Fig, 3 Tab, 32 Ref.

Descriptors: *Weirs, *Hydraulics, *Flow measurement, Discharge coefficient, Natural streams, Laboratories, Mathematical studies, Triangular weirs, V-notch weirs, Streamflow.

The triangular-notch thin-plate weir is a convenient, relatively precise flow-measuring instrument frequently used to measure the flow of water in laboratories and in small streams. A comprehensive analysis of the discharge characteristics of triangular-notch weirs is presented, previously published data are analyzed in the light of the effective-head concept, and a new weir discharge formula is proposed. Coefficients are recommended, requirements for precise measurements are described, and limits of applicability are discussed. An extensive review of the literature of triangular weirs is included. (USGS)
W82-02842

INSTRUMENTATION FOR AERATED FLOW ON SPILLWAYS,
Ministry of Energy, Wellington (New Zealand).
For primary bibliographic entry see Field 7B.
W82-02880

COEFFICIENT OF FRICTION IN CONDUITS WITH LARGE ROUGHNESS,
Hawksley (Watson), High Wycombe (England).
R. Pyle, and P. Novak.
Journal of Hydraulic Research, Vol 19, No 2, p 119-140, 1981. 16 fig, 1 Tab, 18 Ref.

Descriptors: *Friction loss, *Conduits, *Roughness coefficient, Drag, Head loss, Model studies, Mathematical models, Hydraulics, Channel flow.

A mathematical model is presented for computing the friction coefficient of a conduit with roughness elements of any size or shape. No further hydraulic experiments are required to use this method, which is based on coefficient of drag. To gather reference data three conduits with different types of roughness elements (single size spheres, 16.5 mm diameter; single size hemispheres, 33 mm diameter; and natural river stones up to 150 mm) were used. A total of 13 element concentrations were included. A further modification of the model enabled computation of the friction coefficient for the above element shapes as well as for cylinders or prisms of varying sizes and testing on top of each other. The friction coefficient of natural river stones was greater than that obtained from a series of cylinders and less than that obtained from a series of prisms. (Cassar-FRC)
W82-02901

DISTRIBUTION OF WASTEWATER IN DRAIN FIELD PIPES,
Cowiconsult, Virum (Denmark).
R. Wiuff.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE5, p 1009-1024, October, 1981. 19 Fig, 1 Tab, 7 Ref.

Descriptors: *Septic tanks, *Drainage engineering, *Wastewater disposal, Percolation, Pipe flow, Hydraulics, Sanitary engineering.

The outflow from a septic tank drain field pipe, fitted with evenly spaced circular holes along the bottom, was analyzed for steady flow conditions and unsteady flow conditions produced by lavatory flushes or bath water disposal. Experiments were carried out on a pipe 10 meters long, 0.094 m diameter, with 18 evenly spaced holes 0.011 m in diameter, and slope up to 2.5%. Under steady flow with maximum discharge and maximum slope, only the first 15 holes discharged. A drain field was designed to accomodate a 210 liter per person per day wastewater system. At a slope of 1% and a pipe length of 12 meters, it was calculated that even spacing of 28 drain holes in the pipe would cause most of the water to drain out within the first 3 or 4 meters. A more even distribution of water would be obtained with 3 holes in the first third, 6 holes in the second third, and 19 holes in the last third. This arrangement would eliminate the need for pumps and siphons. (Cassar-FRC)
W82-02945

8C. Hydraulic Machinery

NEW JET-GATE DESIGN,
I. E. Mikhailov, and V. I. Bobrov.
Hydrotechnical Construction, No 6, p 571-574, June, 1980. 3 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 6, p 19-21, June, 1980.

Descriptors: *Flow regulators, *Energy dissipation, *Hydraulic gates, Hydroelectric plants, Flow characteristics, Flow control, Flow discharge, *Gates, Hydraulic structures, High pressure gates, Jet gates, Mixing, Nozzles, Fluid mechanics, Regulated flow, Sluice gates, Construction engineering, Design criteria.

The high head, high capacity jet regulating gate was evaluated in a laboratory model. This type of gate operates at heads of 300 m and greater and dissipates excess energy in the discharge by impacting the jets together in the flow merging chamber. Flow regulation can be accomplished by adjusting the position of the nozzles. Installation of jet gates can substantially reduce costs of hydroelectric plant construction. A model with a cylindrical flow merging chamber, 240 mm in diameter and 250 mm in length, was fitted with 2 nozzles. The two series of runs were done with nozzles wither 30 mm or 40 mm in diameter. Heads ranged from 4 to 200 m, outflows from 2 to 10 m. A family of curves was developed to describe the flow characteristics at each nozzle diameter with different heads and relative gate openings. Smooth flow regulation was obtained at relative gate openings < or = 1.2-1.4. Further increases in gate openings did not change the flow. Gate capacity was not affected by variations in outflow within the range 2-10 m under constant head. Almost all the excess energy of the discharge (> 99%) was dissipated in the flow merging chamber. (Cassar-FRC)
W82-02691

THE CONE PUMP,
Weir Pumps Ltd., Glasgow (Scotland).
M. Ryall.
Water Services, Vol 85, No 1026, p 394-396, August, 1981.

Descriptors: *Pumps, *Design criteria, Wastewater treatment, Drainage.

A new type of pump is described which is useful for a wide range of low head duties, particularly in land drainage and handling and treatment of sewage. The pump was designed to consider several needs, including minimizing hydraulic friction losses, avoidance of excessive immersion levels in the suction sump at maximum flow, achievement of stable self-regulating flow, reduction of overall diameter to minimize construction cost, simplification of component shapes to reduce tooling costs, pumping of liquids containing solids, and making powder consumption as closely proportional to flow as possible. The pump design is based on the concept of centrifugal force acting on a liquid, which cannot escape in any direction but upwards. The Cone pump performs its required duties reliably over a range of heads and flows similar to the commonly used screw pumps and is lighter, more compact and easier to install. (Baker-FRC)
W82-02713

8D. Soil Mechanics

RATIONAL DIMENSIONS OF AN EARTH BLANKET AND ITS SEEPAGE CALCULATION,
For primary bibliographic entry see Field 8A.
W82-02666

CALCULATION OF THE STRENGTH OF RIGID DIAPHRAGMS IN EARTH DAMS,
P. D. Evdokimov.
Hydrotechnical Construction, No 3, p 263-267, March, 1980. 2 Fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 31-33, March, 1980.

Descriptors: *Earth dams, *Dam stability, *Friction, Strength, Mathematical studies, Estimating equations.

The effect of the earth's frictional forces on the diaphragm surface of earth dams was calculated. All of the normal and tangential forces that act on the diaphragm surface were considered. The first case considered was the horizontal reaction in the foot of the diaphragm, which is less than or equal to the frictional force where the foot is not displaced. The second case considered the horizontal reaction in the foot of the diaphragm when the foot is displaced. In both cases, the frictional forces of the earth on the diaphragm reduced the horizontal reaction of the earth of the downstream shoulder. There was resistance to the horizontal displacement of the diaphragm toward the downstream shoulder of the dam. This increases the stability of the downstream slope of the dam and improves the state of stress of the diaphragm. (Small-FRC)
W82-02667

CALCULATION OF FOUNDATIONS AND EARTH DAMS,
P. D. Evdokimov.
Hydrotechnical Construction, No 4, p 395-398, April, 1980. 4 Fig, 11 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 4, p 41-43, April, 1980.

Descriptors: *Dam stability, *Earth pressure, Soil mechanics, Shear stress, *Earth dams, Clays, Deformation, Pressure distribution.

The forces acting on an earth-rock dam with a clay core are analyzed for three situations: completely stabilized, incompletely stabilized, and completely unstabilized. The resulting diagrams of earth pressure of the downstream shoulder can be used to construct the diagram of moment over the height of the core and the diagram of shearing forces. From these the stressed state of the core can be determined from the equation of nonuniform compression. The degree of stability of the dam can be obtained from the earth pressure of the downstream shoulder and the passive earth pressure of the downstream shoulder. (Cassar-FRC)
W82-02689

COMPUTING THE SETTLEMENT OF THIN ANTISEEPAGE WALLS FORMED FROM CLAYEY SOILS,
V. P. Nedriga, A. M. Gladilin, and I. P. Chernyi.
Hydrotechnical Construction, No 1, p 29-32, January, 1980. 1 Fig, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 1, p 17-19, January, 1980.

Descriptors: *Seepage control, *Clays, Soil mechanics, Hydraulic structures, Dams, Mathematical equations.

Expressions are developed to calculate the settlement of fluid clay in an antiseepage wall built within a dam or other hydraulic structures. Settlement in the upper boundary area results from the lateral outflow of filtrate through the edge of the curtain. The properties of the clay material used for filler and of the soil surrounding the structure significantly affected the amount of settlement. The mathematical equation was used on a clay wall 10 m high and 0.15 m thick, with other specified parameters (density of clay, porosity of clay, coefficient of friction between clay and the edge of the curtain, etc.). The computed height after settlement was 9.13 m, or about 9%. This agreed with observations reported in the literature. (Cassar-FRC)
W82-02692

SLOPE FAILURES AND TAILING DAM DAMAGE IN THE 1978 IZU-OHSHIMA-KINKAI EARTHQUAKE,
Tokai Univ., Shizouka (Japan). Faculty of Marine Science and Technology.
S. Okusa, and S. Anma.
Engineering Geology, Vol 16, No 3/4, p 195-224, November, 1980. 24 Fig, 7 Tab, 15 Ref.

Descriptors: *Earthquake engineering, *Slope stability, *Dam failure, *Earthquakes, Landslides, Avalanches, Hazards, *Japan, Izu-Ohshima-Kinkai earthquake.

The general characteristics are described of the failures of natural slopes and embankments which occurred during the Izu-Ohshima-Kinkai earthquake (7.0 on the Richter scale, January 14, 1978). Most of the hazards caused by the quake related to the slope failures of sea cliffs, river cliffs, and road cuttings of convex vertical section with the upper parts sloping gently and the lower parts sloping steeply. Large slope failures occurred close to the activated faults. Damage to high concrete retaining walls was due to insufficient bearing capacity of the foundation soil. Buildings in the meizoseismal zone were damaged due to sliding of the underlying embankments and ground displacement due to the activated faults. Deaths and injuries were caused by falling rock blocks and sliding soil masses which struck homes and cars at the foot of steep slopes. Heavy rain may cause secondary failures, rockfalls, and avalanches due to tension

cracks in the middle and upper part of steep slopes. (Small-FRC)
W82-02891

8E. Rock Mechanics and Geology

OUTFLOW OF VOLCANIC ROCK AND GAS DURING OPENING OF THE ARPA-SEVAN TUNNEL,
For primary bibliographic entry see Field 2A.
W82-02772

GEOTECHNICAL INVESTIGATIONS AT THE KALYANI DAM SITE, CHITTOOR DISTRICT, ANDHRA-PRADESH INDIA,
National Geophysical Research Inst., Hyderabad (India).
S. Balakrishna, B. Venkatanarayana, and Y. V. Ramana.
Engineering Geology, Vol 15, No 3/4, p 205-222, March, 1980. 6 Fig, 4 Tab, 14 Ref.

Descriptors: *Dam design, *Rock properties, *Foundation rocks, Dam construction, *Kalyani Dam, *India, Grouting, Rock mechanics, Tectonics.

The Kalyani Dam site, India, required extensive geophysical studies because it is in a tectonically distured region. Several fault and shear zones are present. There were significant differences between the sheared rocks and the undisturbed samples. The sheared rocks had high porosity and elastic anisotropy; low values for density, elastic wave velocity, elastic moduli, and fracture strength; and high absorption. The undisturbed samples showed the reverse characteristics. Shear zone samples also varied in compressional velocity and amplitude, signs of compressive stress. These studies identified the sound and weak rock formations and aided in economical siting of the dam, in proper design (deepening the foundation in fault zones, for example), and in planning the grouting. (Cassar-FRC)
W82-02890

8G. Materials

GALVANIZED PIPE VIES FOR EQUAL ALTERNATIVE STATUS IN STORM SEWER PROJECTS.
Water and Pollution Control, Vol 118, No 7, p 16-17, 1980.

Descriptors: *Pipes, *Storm sewers, Sewers, Construction materials, Galvanized steel, *British Columbia.

Corrugated steel pipe has been used over 8 or 9 years as an alternative for concrete storm sewers. With the successes of the past in mind, it was suggested that Prince George City, British Columbia, could benefit by the use of a second system of corrugated steel sewer pipe. Two critical objections have been raised: optimum water capacity and durability. A formula has been devised that takes into account the hydraulics of smooth bore pipe. To meet the need for maximum capacity, the Hel-Cor Smooth-Flo pipe is prepared with a full circumferential lining of asphalt spun on at high speed in the manufacturing process. The result is a Manning 'n' factor of 0.012. While severe frosts have rippled some sections of pipe over the last few years, other sections are in mint condition. Corrugated steel pipe is now required for catch basin leads because steel will not shatter when blasted with steam to thaw frozen catch basin leads and does not crack under the stress of expansion during freezing. Corrugated steel pipe has a built-in flexibility through the use of 0-ring gaskets and hugger-band joints. Rubber gaskets were used to limit infiltration in this particular project, as the water table north of Prince George is particularly high, and the storm system is needed to direct water during the spring runoff to the Nechako River. Corrugated steel pipe weighs about one tenth as much as comparable concrete pipe. It is flexible and has high compressive strength. (Baker-FRC)
W82-02601

IMPROVEMENT OF THE SEALS OF EXPANSION JOINTS OF HYDRAULIC STRUCTURES,
For primary bibliographic entry see Field 8A.
W82-02669

USE OF CRACK-RESISTANT LININGS OF HYDRAULIC TUNNELS WITH CONSOLIDATION GROUTING OF THE ROCK,
For primary bibliographic entry see Field 8A.
W82-02670

BITUMINOUS CONCRETE ANTISEEPAGE CURTAIN FOR CONCRETE DAMS,
For primary bibliographic entry see Field 8A.
W82-02690

SCROLL CASINGS OF STEEL AND REINFORCED-CONCRETE CONSTRUCTION,
A. N. Mordovina.
Hydrotechnical Construction, No 3, p 245-251, March, 1980. 4 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 3, p 21-25, March, 1980.

Descriptors: *Casings, *Hydroelectric plants, *Concrete construction, Scroll casings, Steel, Reinforced concrete, Water conveyance, Conduits, *Materials engineering, *USSR.

A combined steel and reinforced concrete scroll casing for hydraulic stations was the most reliable construction of several models tested--steel with ribs, cast metal, banded constructions, reinforced concrete prestressed in an annular meridional direction, and precast monolithic concrete reinforced by prestressed bars. The steel-reinforced concrete construction consisted of a scroll-shaped metal shell imbedded in a reinforced concrete block. The steel and concrete interact elastically to reduce stress on the metal. The stresses were 186 MPa, compared with 560 MPa in the all-metal scroll casing. Scroll casings using this type of construction have been intalled at the Nurek hydrostation, and similar casings are being installed in the Inguri, Sayano-Shushenskoe, and Rogun plants. (Cassar-FRC)
W82-02784

STRESS RELAXATION IN CONCRETE OF MASSIVE HYDRAULIC STRUCTURES,
For primary bibliographic entry see Field 8A.
W82-02786

VINYL LINED ASBESTOS CEMENT PIPE PROBLEMS, OPERATOR ASPECTS,
Champlain Water District, South Burlington, VT.
For primary bibliographic entry see Field 5B.
W82-02898

DESIGN AND DEVELOPMENT OF AN AUTOMATED HYDROSTATIC FLEXIBLE MEMBRANE TEST FACILITY,
Water and Power Resources Services, Denver, CO. Engineering and Research Center.
R. K. Frobel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-210809, Price codes: A03 in paper copy, A01 in microfiche. Report REC-ERC-80-9, January, 1981. 28 p, 12 Fig, 1 Tab, 2 Ref, 2 Append.

Descriptors: *Linings, *Membranes, *Testing procedures, *Materials testings, Automation, Computers, *Hydrostatic pressure, Polymers.

An automated hydrostatic test facility was designed and fabricated for testing flexible membrane liners over variable subgrade conditions. The test facility is composed of pressure vessels which are controlled and monitored by a computer. Selected flexible membranes are placed over subgrades in the vessels, the vessels are charge with water, and hydrostatic head is varied using air pressure. The equipment is versatile, easy to use, and adaptable to future research on other hydraulic barrier materials, geotechnical fabrics, or soils. Preliminary testing of a 0.25 mm polyvinyl chloride lining material on the hydrostatic test facility showed that the equipment functioned as designed. The test results indicate that failures, pressures, and time to failure were reasonably reproducible from test to test over the same type of subgrade. Failures over the roughest subgrade occurred in a depression between large aggregates, whereas failure over the finer subgrades occurred predominantly over small sharp aggregate. (Moore-SRC)
W82-02978

8H. Rapid Excavation

APPLICABILITY AND DESIGN CRITERIA OF A BLASTING METHOD FOR CONSTRUCTING DEEP-CUT SECTIONS OF A CANAL FOR TRANSFERRING PART OF THE FLOW OF SIBERIAN RIVERS,
A. E. Azarkovich, and P. P. Chatalbashev.
Hydrotechnical Construction, No 1, p 6-11, January, 1980. 2 Fig, 2 Tab, 3 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 1, p 5-8, January, 1980.

Descriptors: *Explosives, *Excavation, *Canal construction, *Siberia, Water transfer, Hydraulic structures, Diversion structures, Design criteria, Soil engineering, Water conveyance.

The sidecasting blast technique is discussed as a method of soil excavation for deep cut sections of a proposed 2273 km water transfer canal in Siberia. Explosives are set in trenches to excavate non-rock material. The method is not applicable in saturated soils with high groundwater tables and in quicksand-type soils. Two alternatives are described: first, a design canal depth 15% greater than when using earth excavation techniques, with bank trimming over the whole bank height (including below the water level); and second, a design cross-section of excavation below the given water level with bank trimming above the canal water level. This blasting method is considered for 279 km of deep cut sections, amounting to 12% of the total length and 800 million cu m (25% of the total excavation volume). Total explosive requirements (ammonium nitrate-diesel fuel) are 2-3 million tons over a 6 year period. The second alternative as compared with earth excavation without blasting would reduce capital and labor by 50%, length of construction by 2 years, adjusted expenditure by 17%, and the need for earth moving equipment. However, blasting on this large scale has not been attempted to date. (Cassar-FRC)
W82-02783

EXPERIENCE WITH AND THE EFFECTIVENESS OF AUTOMATIC SYSTEMS FOR CONTROL OF LOADING-HAULING OPERATIONS DURING CONSTRUCTION OF THE DAM FOR NUREK HYDROELECTRIC PLANT,
For primary bibliographic entry see Field 8A.
W82-02948

8I. Fisheries Engineering

PP AND I USES DISCHARGE WATER FOR FISH FARMING.
For primary bibliographic entry see Field 3C.
W82-02645

USE OF FISH LARVA MORPHOMETRY TO PREDICT EXCLUSION CAPABILITIES OF SMALL-MESH SCREENS AT COOLING-WATER INTAKES,
Michigan Univ., Ann Arbor. Inst. of Science and Technology.
P. J. Schneeberger, and D. J. Jude.
Transactions of the American Fisheries Society, Vol 110, No 2, p 246-252, March, 1981. 2 Fig, 3 Tab, 26 Ref.

Descriptors: *Entrainment, *Mathematical studies, *Screens, *Intakes, Powerplants, Cooling water, *Fish eggs, Regression analysis, Fishkill, *Fish barriers.

Water used for cooling powerplants often contains large numbers of fish larvae that may sometimes be saved by small mesh screens over intake systems. A relationship between total length and body depth and width of fish larvae was used to calculate the efficiency of small-mesh screens in preventing the entrainment of fish larvae at cooling water intakes of powerplants. Regression analyses were used to calculate total lengths of larvae corresponding to body depths of 0.5, 1.0 and 2.0 mm for each species. These lengths were then compared to cumulative length frequencies for the most commonly entrained larvae at the Campbell Powerplant on Lake Michigan in 1978. Results showed that 35-100% (depending on species) of the larvae during this year would not have been entrained if 0.5-mm mesh screening had been used instead of the 9.5-mm bar mesh vertical traveling screens that were used at the intake system. These figures do not consider approach velocities of the intake water, avoidance behavior of larvae or mortality of impinged or extruded larvae. (Geiger-FRC)
W82-02687

EFFECTS OF HYDROLOGICAL AND BIOLOGICAL VARIABLES ON THE SURVIVAL, GROWTH, AND FOOD UTILIZATION OF ESTUARINE FISHES CAGE-CULTURED IN A HEATED WATER SYSTEM,
Texas A and M University, College Station.
For primary bibliographic entry see Field 5C.
W82-02730

FISH MOVEMENT UPSTREAM THROUGH A CENTRAL QUEENSLAND (FITZROY RIVER) COASTAL FISHWAY,
Capricornia Inst. of Advanced Education, Rockhampton (Australia). Dept. of Biology.
J. Kowarsky, and A. H. Ross.
Australian Journal of Marine and Freshwater Research, Vol 32, No 1, p 93-109, 1981. 9 Fig, 4 Tab, 27 Ref.

Descriptors: *Fish passages, *Tidal rivers, *Water level, Dams, Fish barriers, Barriers, *Fitzroy River, Rockhampton, *Australia, Weirs, Rivers, Tailwater, Headwater control, Saline water barriers, Estuaries.

The present fishway at the Fitzroy River barrage, Rockhampton, Australia, did not permit free passage of fish swimming upstream during the sampling period, August 1978 to October 1979. Fish were monitored with a V-trap located above the highest weir in the series of 15 weirs and pools, which form an L-shaped passage. Sixteen species of fish over a wide size range were caught. Species diversity was greatest in summer. Numbers, sizes, and species of fish were affected by tailwater level (peak catches at high tide peak), headwater level, and velocity of the water. Fish accumulated below open barrage gates. Two alternate ways of passing the barrage--via the occasionally inundated flood plain or under open barrage gates-- were not believed feasible. Suggested structural changes were: (1) replacement of the pool and weir design with submerged orifice or vertical slot arrangements, (2) modification of the entrance configuration, (3) installation of telescoping wiers above the fishing exit, (4) extension of the fishway length, and (5) changes in operating policies to account for known effects of tailwater and headwater levels and seasonal variation in species and abundance. (Cassar-FRC)
W82-02800

URBAN AQUACULTURE OF THE RAINBOW TROUT (SALMO GAIRDNERI),
District of Columbia Univ., Washington. Dept. of Environmental Science.
A. J. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-168576, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Report No 29, September, 1981. 15 p, 3 Fig, 4 Tab, 10 Ref. OWRT-A-007-DC(1). 14-34-001-9009.

Descriptors: *Aquaculture, *Recycling, Closed water systems, Aquaria, *Trout, *Fish farming, Temperature effects, Fish food, Vitamins, Amino acids, Rainbow trout, Closed systems.

The raising of the rainbow trout (Salmo gairdneri) in a closed recycling water system in an urban environment is described. Germ-free fingerling trout were raised on a controlled diet over a period of nine (9) months in specially constructed, refrigerated aquaria maintained at 10C and 15C. The results show that this trout adapts well to the environment provided for it and increases in weight and length comparable to or at a more accelerated rate than those raised by conventional fish-farming methods. Rainbow trout raised at 10C have a somewhat slower rate of growth than those raised at 15C. Oxygen concentrations, temperature, and bacterial counts were constantly monitored. This process, with slight modifications, could be used to launch a commercial venture in the urban aquculture of the rainbow trout.
W82-02812

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Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 2H.
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For primary bibliographic entry see Field 6G.
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